AERONAUTICAL ENGINEERING REVIEW

INSTITUTE OF THE AERONAUTICAL SCIENCES

AUGUST 1947

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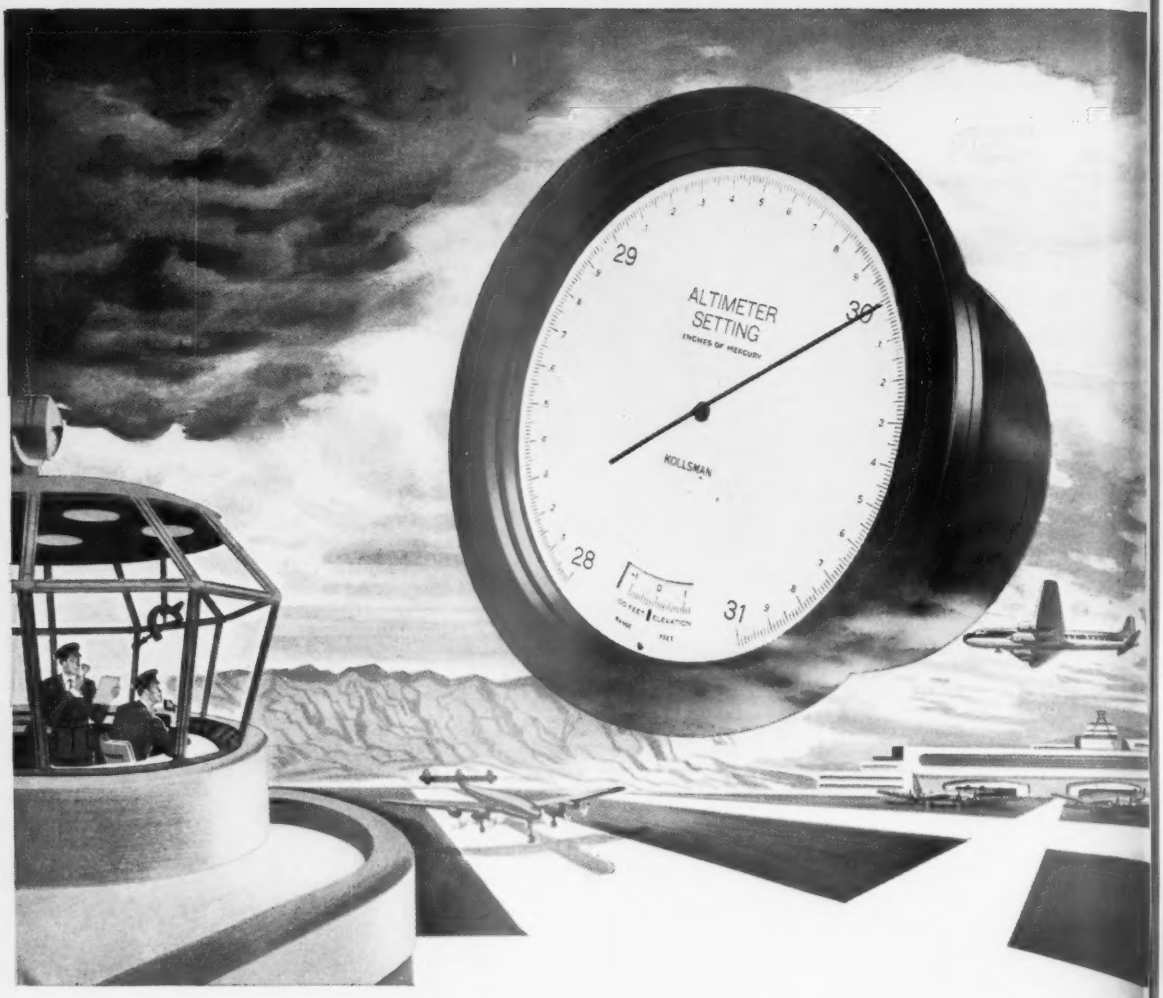

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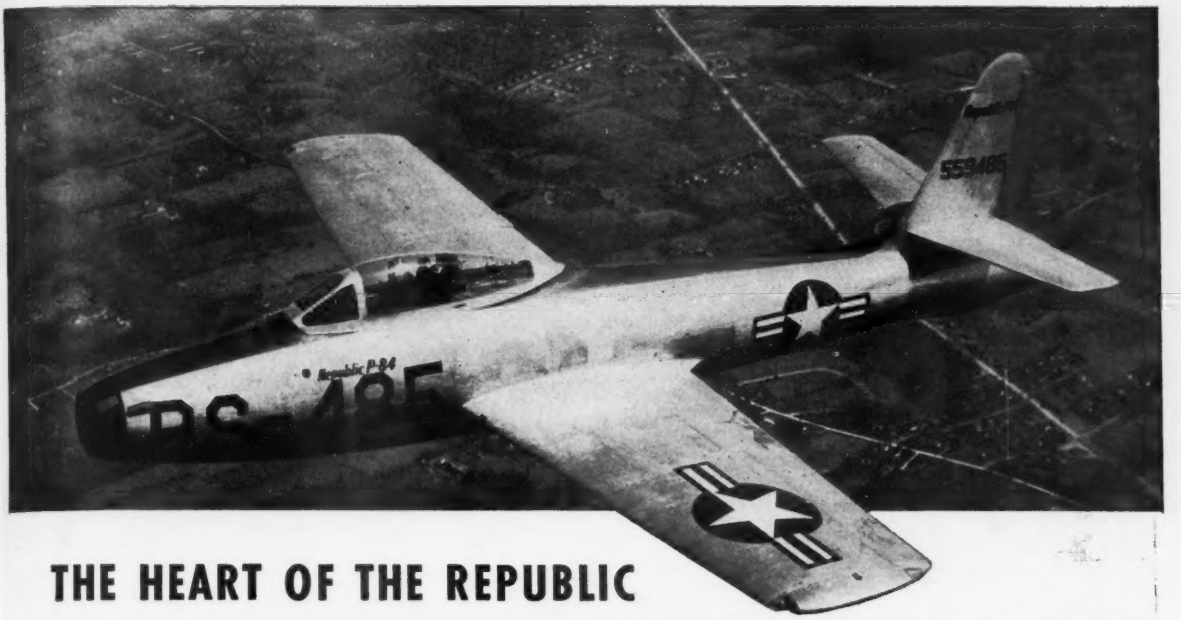

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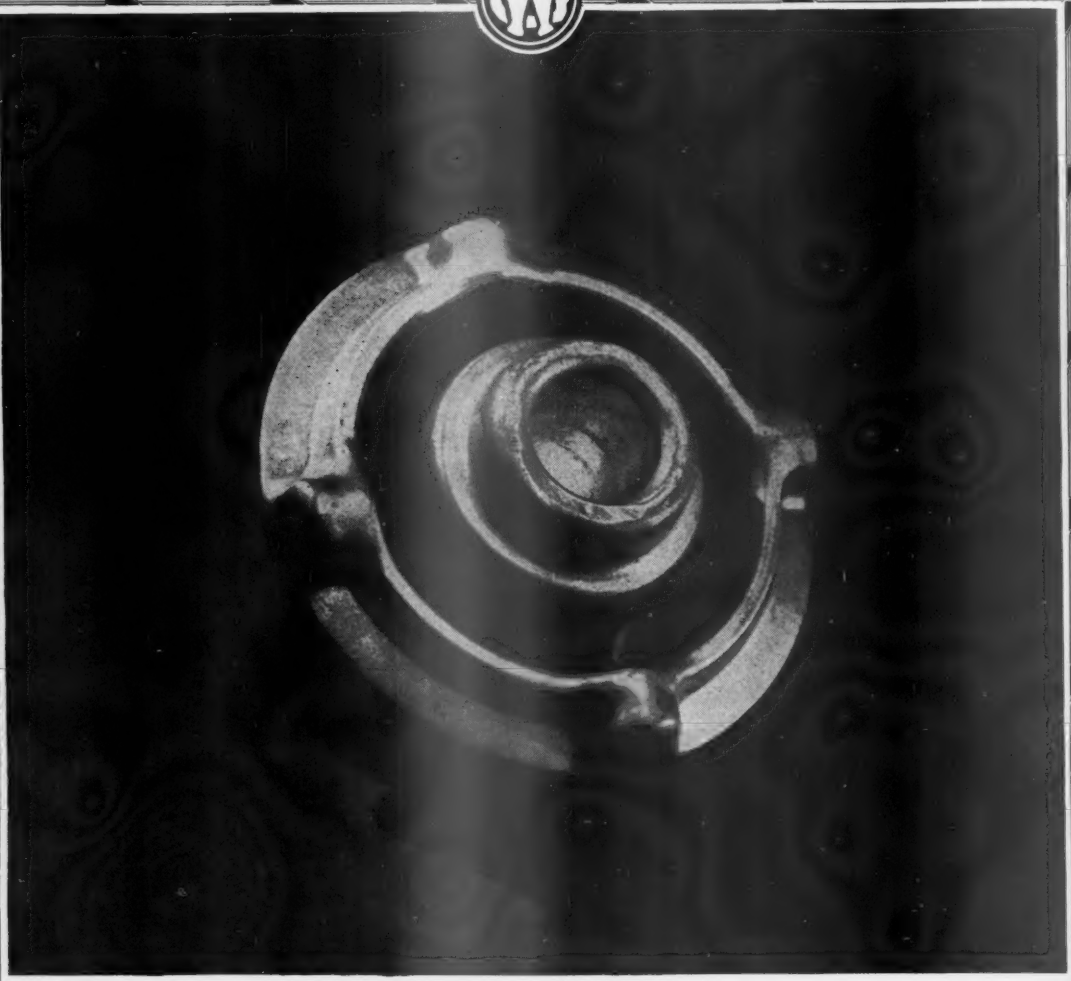

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AERONAUTICAL ENGINEERING REVIEW

Vol. 6 August, 1947 No. 8

Cover—German Arada, at Naval Air Material Center, about to be launched from catapult taken off the captured German vessel "Prinz Eugen."

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I.A.S. News

A Record of People and Events of Interest to Institute Members

Celebrate 15th Anniversary at Summer Meeting Dinner

Assistant Secretary of Navy for Air, Guest of Honor, Discusses Future National Defense; Welcomes New U.S. Air Force as Sister Service with Great Tradition

MARKING THE Institute of the Aeronautical Science's 15th Anniversary, members celebrated establishment of the organization in 1932 by the original founder members at the Annual Summer Meeting Dinner held in the Embassy Room of the Hotel Ambassador, Los Angeles, August 8. Guest of honor and principal speaker of the evening was John Nicholas Brown, Assistant Secretary of Navy for Air and an Honorary Member of the Institute, who appeared in place of James V. Forrestal, formerly Secretary of Navy, now Secretary of Defense.

Occasion was further marked by the presence of Past-Presidents of the Institute who were called upon by Toastmaster Preston R. Bassett, this year's President, to recount some of the outstanding services rendered by I.A.S. to the aviation industry since the first Annual Meeting at Columbia University in New York on January 26, 1933.

▸ **Balanced Defense**—In his speech the Assistant Secretary of Navy for Air spoke on "Balanced National Defense" in which he welcomed the U.S. Air Force as a sister service with a tradition of great triumph already behind it.

The speech was a discussion of the means by which the National Security Act of 1947 is intended to give us a national defense setup that will be in balance without respect to the size of the several services. Some details of how such a defense organization will be arrived at were given by the Assistant Secretary.

This law, Mr. Brown said, is essentially a plan for relating to each other all of the elements upon which we rely for the safety of the United States.

Brief mention was made of the future of Naval aviation within the new defense organization.

▸ **15 Years' Accomplishments**—"Gene" Root, Los Angeles Section Chairman and Host for the Summer Meeting, introduced President Preston R. Bassett, who reviewed the Institute's 15 years of accomplishments in serving the industry. Mr. Bassett then called on the Past-Presidents who were present to brief members on particular achievements in each of the years of their periods of office.

The 2-day program, beginning August 7, got under way with the morning session: "Techniques of High Speed Model Testing," chairmanned by A. E. Puckett, Chief, Wind Tunnel Section, Jet Propulsion Laboratory, California Institute of Technology.

Afternoon session, under chairmanship of Smith J. de France, Engineer-in-Charge, Ames Aeronautical Laboratory, N.A.C.A., was devoted to "Progress in High Speed Flight Research."

On August 8, A. E. Lombard, Jr., Engineering Consultant, Consolidated Vultee Aircraft Corporation, conducted the morning session entitled "Design and Performance Trends."

John Nicholas Brown, Assistant Secretary of Navy for Air.

Final session in the afternoon, "Powerplant and Aircraft Development," was under chairmanship of Arthur E. Raymond, Vice-President—Engineering, Douglas Aircraft Company, Inc.

Much of the Meeting's success can be attributed to the Program Committee, under Chairman Willis M. Hawkins, Lockheed Aircraft Corporation, which made all arrangements for the sessions.

I.A.S. Calendar

September 2–6, 1947	Joint Meeting, Royal Aeronautical Society, London, England
December 17, 1947	Wright Brothers Lecture, Washington, D.C.
January 27–29, 1948	Sixteenth Annual Meeting, New York

For details see page 64

I.A.S. Members View Latest Navy Air Developments at Philadelphia Naval Base Air Units

Admiral Royce Welcomes Institute to Air Material Center at League Island and Johnsville Aircraft Modification Unit

Opportunity to see Navy's newest developments in guided missiles and aircraft control and launching devices was given 113 aviation experts and members of the Institute of the Aeronautical Sciences June 18 and 19. The tour was part of a 2-day visit to the Naval Air Material Center at League Island and its subordinate command, Naval Aircraft Modification Unit, at Johnsville. Various phases of experimental, test, and development work being conducted by the Navy were exhibited and demonstrated, and Institute members were able to exchange views with the Navy on aeronautical problems vital to national defense.

▶**Four Commands**—Naval Air Material Center is divided into four subordinate commands: Naval Aircraft Factory (forerunner of N.A.M.C.); Naval Experimental Station, which develops new types of aircraft equipment; Naval Auxiliary Air Station, which tests Navy planes and operates Mustin Field; and Naval Aircraft Modification Unit.

Main function of N.A.M.C. is to undertake high priority test and development work for Bureau of Aeronautics on a job-lot basis. Center also helps determine standard specifications for airplane parts and many types of materials.

▶**Modification Unit**—First day's visit was to the Aircraft Modification Unit at Johnsville, 20 miles north of Philadelphia, where Navy modifies planes for special purposes and does experimental work on special weapons.

Following an address of welcome by Capt. C. E. Kirkbride, Commanding Officer of the Modification Unit, a talk on "Guided Missiles" was given accompanied by official Navy films on the history of the subject.

Included in the program were field demonstrations of a pilotless F6F-5K Drone (regular Grumman Hellcat with radio control, a type used at Bikini atomic bomb tests); a TD2C Drone exhibition; firing of acid-aniline engines used to power pilotless aircraft, and firing of pulse-jet engines.

The day ended with a dinner held at the Engineers Club attended by Rear Adm. Donald Royce, Commander, Naval Air Material Center, and his staff.

▶**Catapult Demonstration** — Next day's tour was of the Air Material Center, site of the Naval Aircraft Factory, said to carry on a greater diversity of aeronautical work than any other similar aeronautical organization in the world.

Welcomed by Admiral Royce, members observed demonstrations of several types of catapults, including a German model, and arresting gear installations.

A luncheon was given the group at the Officers Club at which the picture (*above*) of members and Navy personnel was taken.

In addition, the group was conducted through the Center's various laboratories including Aeronautical Materials, Structures, Engine, Instruments, Radio and Radar, Medical, and Aeronautical Photographic Experimental.

Additional photos of the tour may be found on the front cover and on pages 20 and 21.

Fairchild Publication Fund Expanded

A program for the use of the Publication Fund provided the Institute several years ago by Sherman M. Fairchild has recently been inaugurated. This Fund, originally intended for use in the publishing of important but highly specialized papers, has not been fully employed during the war years because of lack of man power, paper shortages, and other limiting factors.

Plans now being carried out (with the approval of Mr. Fairchild and the Fund Committee) call for a broader use of the Fund than was originally conceived. Through this program, the Institute is now in a position to render another valuable service to its members and to the industry.

Printing, ozalid, and photostating equipment, permitting rapid and inexpensive reproduction of papers and articles in preprint form, have been installed in the Institute's New York offices. A special department to handle the production and distribution of all preprints has also been set up.

Because of space limitations in the REVIEW and the JOURNAL OF THE AERONAUTICAL SCIENCES, it has been impossible in the past to publish all worthy papers received by the Institute or presented at its meetings. Many such papers, of high technical value but of interest to a comparatively small group of specialists in particular fields, have had to go by the board. These papers and all similar ones received in the future can now be made available to members at nominal cost.

The Preprint Page (page 19 in this issue) will be utilized each month to list all papers currently available.

Soderberg Named M.I.T. Engineering Department Head

Appointment of Prof. C. Richard Soderberg as Head of Massachusetts Institute of Technology Department of Mechanical Engineering has been announced by President Karl T. Compton. An Associate Fellow of I.A.S., Professor Soderberg's appointment will permit Dr. Jerome C. Hunsaker, who has been head of both the departments of mechanical and aeronautical engineering since 1933, to devote entire attention to direction of M.I.T.'s rapidly expanding program of research and instruction in aeronautical engineering, a field in which he is widely recognized as an authority.

▸**Authority on Turbine Design**—Professor Soderberg, who has been

Sherman M. Fairchild.

Deputy Head of the Department of Mechanical Engineering and is well known in applied mechanics field, is an internationally recognized authority on turbine design.

Before coming to M.I.T. in 1938, Professor Soderberg was Manager of Westinghouse Electric Corporation's Turbine Division. A native of Sweden, he came to this country in 1919 on a fellowship from the Scandinavian-American Foundation, spending a year in advanced study of naval architecture at M.I.T. and the University of Michigan. He received a bachelor's degree from M.I.T.

▸**War Duties**—During World War II Professor Soderberg served on the National Advisory Committee for Aeronautics' special committee on jet propulsion. Other services: consultant on development and design of power plants in torpedoes; served on Government committees for studies of tank design and evaluation of gas turbine power plants for ships; consultant to various engineering firms engaged in war work.

Since the war he has been a member of the subcommittee on turbines of N.A.C.A. and chairman of the panel for aircraft, fuels, and propulsion of the Scientific Advisory Board of Army Air Forces.

A member of the National Academy of Sciences, Professor Soderberg is a Fellow of the American Academy of Arts and Sciences, a member of the American Society of Mechanical Engineers, Society of Naval Architects and Marine Engineers, and Society of Automotive Engineers. He also is a member of the British Institution of Mechanical Engineers, Svenska Teknologforeningen, and American Society of Swedish Engineers.

W. A. M. Burden, an Honorary Member of the Institute, resigned as Assistant Secretary of Commerce for Air, effective June 30.

▸**Named to Air Safety Board**—Dr. Hunsaker, who recently was named to President Truman's special Air Safety Investigating Board, as head of Department of Aeronautical Engineering, will have charge of Navy's new supersonic wind tunnel now under construction.

An Honorary Fellow and first President of I.A.S., Dr. Hunsaker has been active in aeronautics since 1913. In 1941 he was called to Washington to serve as Coordinator of Research and Development for the Navy Department. Later he succeeded Dr. Vannevar Bush as Chairman of N.A.C.A. At the same time he continued to handle the general administration of M.I.T.'s Department of Aeronautical and Mechanical Engineering with the assistance of Professor Soderberg as deputy for mechanical engineering and Professor Otto C. Koppen as deputy for aeronautical engineering.

Dr. Hunsaker is an Honorary Fellow of the Royal Aeronautical Society, an Honorary Member of the Institution of Mechanical Engineers of Great Britain and The American Society of Mechanical Engineers, a Fellow of the American Physical Society and American Academy of Arts and Sciences, and a member of other notable scientific societies. In 1933 he was awarded the Daniel Guggenheim medal for his contributions to aeronautical science and in 1942 was honored by the Franklin Institute with award of the Franklin Medal.

I.A.S. Newslines

▸**Capt. Ralph S. Barnaby**, President of Soaring Society of America, has announced a National Soaring Trophy established in memory of late Richard C. du Pont. A Fellow of the Institute, Captain Barnaby is serving fourth term as President of S.S.A.

▶ **Dr. Karl T. Compton,** President of M.I.T. and Fellow of I.A.S., chairmanned President Truman's Advisory Commission on Universal Military Training.

▶ **A. A. Gassner,** Gassner Aircraft Engineering, is heading research into design of coal-burning gas-turbine locomotive for Chesapeake & Ohio Railway. New engine will be jet design. Mr. Gassner is an Associate Fellow.

▶ **F. W. Mesinger,** Associate Fellow, with Norma-Hoffmann Bearings Corporation 28 years, recently was elected to Board of Directors at stockholders meeting.

▶ **F. R. Shanley,** a Fellow of I.A.S. and Division Engineer in Charge of Engineering Research, Lockheed Aircraft Corporation, Burbank, resigned to devote next year to writing on aeronautics and structures.

▶ **D. Roy Shoults** resigned as Vice-President in Charge of Engineering, Bell Aircraft Corporation. An Associate Fellow of the Institute, Shoults recently was elected National Chairman of Aircraft Industries Association.

▶ **Robert J. Woods,** resigned from Bell Aircraft's board, will continue with Bell as engineering consultant. Woods is a Fellow of the Institute.

Gifts to the Institute Collections

Insignia of the air forces of China, Czechoslovakia, Denmark, Finland, France, Great Britain, India, the Netherlands, and Portugal were received from Robert Blackburn, of London. Mrs. Bella C. Landauer added to her previous generous gifts with an American print, "Fairmount," showing various modes of transportation in the nineteenth century, including a balloon. Jerome C. Lederer added N.A.C.A. *Wartime Reports* and other publications to his previous gifts. W. A. M. Burden sent 200 issues of periodicals, adding to his previous generous gifts.

The Institute for Mathematics and Mechanics of New York University gave 18 of its reports. Preprints of its *Symposium on the Failure of Metals by Fatigue* were received from The University of Melbourne through the courtesy of J. Neill Greenwood. A *Bibliography on Aviation and Economic Entomology* of the U.S. Department of Agriculture was received from the Manufacturers Aircraft Association through the courtesy of James M. Clark. Copies of *Pressure Pattern Flight* and *Single Heading Flight* were received from the Special Devices Center of the U.S. Navy Department. Charles-Yves Peslin, of Brest, sent his biography of Jean-Marie Le Bris, the French glider pioneer. The British Supply Office added bibliographies, indexes, and translations to its previous generous gifts.

Additional gifts were received from the Air Transport Association of America; British Information Services; Chase Brass and Copper Co., Inc.; V. J. Chalwin; Chrysler Corporation; Fairchild Aircraft Division, Fairchild Engine & Airplane Corporation; Karlis Irbitis; A. Martinot-Lagarde; *Popular Science Monthly;* Reynolds Metals Company; Soaring Society of America; Standard Oil Company of New Jersey; Texas Engineering Experiment Station; Union Industrial Argentina; U.S. Air Matériel Command; Bureau of Ships; Civil Aeronautics Board; Federal Power Commission; Securities and Exchange Commission; and Westinghouse Electric Corporation.

Corporate Member News

● **Aerojet Engineering Corporation** has been selected as interim training center for specialized engineering students by University of California at Los Angeles.

● **Aeroproducts Division** of General Motors Corporation has received contract from University of Illinois for research and development of propeller theory for propellers operating continuously at supersonic speeds, regardless of forward velocity of airplane.

● **Allis-Chalmers Manufacturing Company** has formed new turbopower development department in its Engineering Development Division. New department will pursue turbopower development for ships, locomotives, and stationary plants.

● **American Airlines System** has installed semiautomatic ticket vending machine at Airlines Terminal in New York, has contract for 250 more. Device prints, audits, and issues ticket in less than 5 sec.

● **American Overseas Airlines, Inc.,** has been granted a license by F.C.C. to transmit public correspondence by radio from planes to ground stations.

● **Bendix Aviation Corporation** purchased engine test house, landing gear test building, and air box laboratory—part of its wartime testing plant at South Bend—from War Assets Administration for $80,000.

● **Bendix Products Division,** Bendix Aviation Corporation, has taken over Plant 11, division's former war plant at South Bend, occupying it with equipment for increased production.

● **Boeing Aircraft Company** conducted 3-week preview class for 21 C.A.A. inspectors at new Boeing Stratocruiser Training School. Some 520 air-line employees will take complete training course in classes scheduled to start this summer, continue into 1948.

● **Continental Motors Corporation's** new engine assembly plant at Muskegon has been placed in operation. New plant is part of $10,000,000 reconversion program initiated in past 18 months.

● **Eastern Air Lines, Inc.,** new Mexico City headquarters, located in nine-story building at corner of Paseo de la Reforma and Morelos Avenue, comprise Traffic and Sales Manager, Reservations, Accounting, Express, and Ticket offices.

● **Ethyl Corporation** has announced $20,000,000 construction program for expanding its manufacturing facilities. New investment will provide for additional capacity at company's Baton Rouge, La., plant, now occupying 200 acres.

● **Fairchild Engine & Airplane Corporation** will administer training school for scientists working on Nuclear Energy for Propulsion of Aircraft at Oak Ridge, Tenn.

● **General Electric Company** has established an Airport Lighting Section, responsible for marketing lighting systems for large and small airports, in company's Lighting Division.

● **The Goodyear Tire & Rubber Company's** subsidiary, Goodyear Aircraft Corporation, has acquired 115,000 sq.ft. additional floor space for manufacturing operations in Plant D at Akron Airport. Company has opened newest overseas factory at Uitenhage, South Africa.

● **Minneapolis-Honeywell Regulator Company** has formed subsidiary in Mexico City called Honeywell-Brown, S.A. Company's Aeronautical Division has opened Fort Worth, Tex., office.

● **North American Aviation, Inc.,** has stepped up employment program from 150 to 200 per week at new Long Beach plant preparatory to establishing B-45 assembly line.

● **Pratt & Whitney Aircraft Division** of United Aircraft Corporation will be closed August 22 to September 2 for purpose of taking inventory.

● **Propeller Division,** Curtiss-Wright Corporation, is purchasing 220,000 sq.ft. floor space of a plant adjacent to company's main works in Caldwell Township. Costing $2,900,000, deal with War Assets Administration will give Propeller Division total of about 750,000 sq.ft.

● **The Ryan Aeronautical Company** has purchased design and manufacturing rights to North American Aviation's four-place Navion.

● **Stinson Aircraft Division** of Consolidated Vultee Aircraft Corporation has established business management office to serve Stinson dealers in sales and service merchandising.

● **Trans World Airline** has switched from regional to straight-line organizational structure. Company's International Pilot Training Division, New Castle, Del., has been transferred to Kansas City.

● **Western Air Lines, Inc.,** moved its general offices from 135 S. Doheny Dr., Beverly Hills, to company's new $2,000,000 hangar at Los Angeles Municipal Airport in mid-July.

● **Westinghouse Electric Corporation** has formed two new electronics divisions in Buffalo —Electronic Control Engineering Section and Electronic Control Sales Section. Changes made are in connection with transfer of Industrial Control Division from East Pittsburgh, Pa., to Buffalo.

● **Wright Aeronautical Corporation,** a Division of Curtiss-Wright, entered gas-turbine field with operation of $3,500,000 laboratory at Wood-Ridge, N.J. Comprising 15,000 sq.ft. of floor space, new lab can measure turbine output up to 20,000 hp.

Sections and Branches

Dayton Section

E. W. Robischon, *Secretary*

Featured speaker at the Section's June 26 meeting, attended by more than 300 members and guests, was John K. Northrop, President, Northrop Aircraft, Inc. His paper, "The Development of All-Wing Aircraft," originally prepared for the Royal Aeronautical Society, was presented for the first time in the United States.

▸**Jack Northrop Honored**—Approximately 90 members and guests honored Mr. Northrop at a dinner held at the Engineers Club. Present were Orville Wright, Lt. Gen. N. F. Twining and Brig. Gen. Donald Putt.

In the Technical Session that followed, Northrop traced development of the XB-35 all-wing bomber from its inception to recent test flights in California. His paper was illustrated by slides and motion pictures.

Col. A. A. Arnhym, Chairman of the Section, announced a "Ladies' Night" to be held July 24 at Miami Valley Golf Club. Program will include dinner and group of motion pictures.

Miami Section

Harry C. Archer
Secretary & Treasurer

Meeting of the Section, held at Pan American Airways Maintenance School, Coral Gables, May 29, opened with a general discussion on aircraft structure, comparing tubular and cellular types. R. C. Zinn, Chairman, presided at the meeting attended by 23 members.

A film, titled *Martin Mariner PBM-3 Wing Destruction Tests,* was shown. Testing methods and devices and type of failure shown in the film were discussed.

▸**DC-6 Operation**—Following the film, Frank Micka, P.A.A. DC-6 Project Supervisor, presented his talk on "DC-6 Operation and Specifications." Among the features of the DC-6 described were fully reversible propellers; ejector exhaust system; heated floors and walls; thermal anti-icer to prevent icing on wings, horizontal and vertical stabilizers; ground ventilation that operates automatically; completely automatic cabin supercharging and air conditioning; and land telephone service for last-minute phone calls.

At the business meeting Harry C. Archer was elected Secretary and Treasurer, and plans were made for the July meeting.

New York Section

Otto Kirchner, *Secretary*

In a frank discussion of past experience and future planning, F. R. "Rod" Banks, former Air Commodore, Royal Air Force, gave a talk on aircraft power-plant developments before a joint meeting of the Section, the Society of Automotive Engineers, and The American Society of Mechanical Engineers in the Grand Ballroom, Hotel Pennsylvania, June 23.

▸**Piston Engine on Way Out**—Commodore Banks, who is Technical Director, Associated Ethyl Company, Director of Power Jets (R&D) Ltd., and Director of British Messier Ltd., said that the piston engine, insofar as Britain is concerned, is on the way out—none of the forward types of British aircraft were to be engined with reciprocating engines. However, present types would prevail for about 10 years, since it would be approximately 5 years before prototype turbined aircraft could be ready to fly on air routes and since it would take further years to build up experience and numbers in jet transports.

▸**Jet Short Haul**—Banks further said the jet turbine would be used for short- as well as relatively long-range aircraft. He did not foresee longer ranges than 3,000 miles (4,000 still air) for jet-turbined aircraft; prop-jets, he thought, would be used for longer-ranged aircraft.

▸**High-Speed Problems**—On the question of very high speeds for commercial aircraft, Banks said there would be a number of problems centering around the passenger. Stating that already at present cruising speeds passengers had been seriously hurt in "bumps," he wondered what would happen to them at cruising speeds some 250 m.p.h. greater than maximum cruising speeds today. It was wrongly thought, he said, that there were no bumps at 35,000 and 40,000 ft., there being severe bumps at these altitudes over continental America in summer, for instance.

A discussion period followed Commodore Banks' talk.

San Francisco Section

Don O. Horning, *Secretary*

A demonstration of Ground Controlled Approach System, sponsored by Navy, was offered members of the Section on June 3 meeting at the Moffett Field Naval Air Station. The group, totaling 88 and headed by Manley J. Wood, Program Chairman, was split up and taken on a flight demonstration arranged by courtesy of Capt. G. H. Mills, the Commanding Officer.

▸**G.C.A. Developments** — Meeting first at the Officers Club, members were addressed by Lt. Comdr. C. E. Poynter, Operations Officer, on the significant developments in G.C.A. equipment and changes from Army-type equipment. A training film, illustrating G.C.A. operation, was shown.

Members then adjourned to the airfield for flight demonstration. Two planes—an R-4 and R-5—were used. Headphone sets permitted members to hear instructions from the G.C.A. ground unit to the pilot which brought the plane down to the runway. Meanwhile, the group remaining on the ground observed the unit in operation. By making several flights, all members were able to see operations both from ground and air.

Air transportation for the demonstration was possible through courtesy of Adm. J. W. Reeves, Jr., Commander, Naval Air Transport Service, Moffet Field.

At a business session a Nominating Committee was elected as follows: Dr. R. G. Folsom, University of California, Chairman; Dr. C. A. Cattaneo, Shell Development Company; Frank Coffyn, United Helicopter, Inc.; Ivy Lee, Jr., Ivy Lee Jr. Associates; Prof. Elliott G. Reid, Stanford University, and Donald H. Wood, N.A.C.A.

Seattle Section

Gene B. Williams, *Secretary*

Guided missiles was the subject for three papers given at June 11 meeting of the Section held in the Chamber of Commerce Building. Attended by 160, meeting was chairmanned by Gene B. Williams, Secretary. A sound film showing the design, handling, and firing of German V-2's concluded the session.

▸**Guided Missiles Needed**—First paper, "The Need for Guided Missiles," was delivered by Col. H. R. Oldfield, Project Engineer, Preliminary Missile Design, Boeing Aircraft Company. Colonel Oldfield pointed out that World War II weapons were extremely limited as to application because of mobility of surface targets, speed, and maneuverability of air targets.

Twenty miles was maximum range of surface-to-surface projectiles, 10 sec. was maximum range for surface-to-air projectiles, and $^1/_2$ mile was the maximum distance for air-to-air combat, Colonel Oldfield stated. Technological advances since the war having reduced even these inadequate ranges of unguided missiles, it now is obvious that future missiles must be guided in order to be effective.

▸**Propulsion Problems**—The second paper, "Propulsion Problems Associated with Guided Missiles," by R. G. Christensen, Propulsion Research Engineer, Boeing Aircraft, discussed various factors contributing to selection of a guided-missile power plant. Christensen showed where the turbojet, the turbojet with tail pipe burning, and the ram-jet each have merit as a propulsion medium according to speed range within which missile is designed to fly.

▸**Aerodynamic Problems** — Final paper, also delivered by a Boeing Aircraft engineer, R. C. Uddenberg, Gapa Project Aerodynamicist, dealt with "Aerodynamic Problems Associated with Guided Missiles." Uddenberg discussed aerodynamic theory of subsonic, transonic, and supersonic flight, pointing out the difficulty involved in practical selection of correct theory on which to base guided-missile design. Wind-tunnel tests provide the key to all successful development of supersonic missiles, and these tests are now being emphasized in design work, Uddenberg said.

Aeronautical University

Meeting June 27 under chairmanship of William Stakee, members heard Gunter Schwandt, Instructor, Aircraft Structures, Aeronautical University, on subjects of "Wing Structure Testing" and "Aircraft Safety Measures."

Illustrating his first talk with films—*Materials and Processing, Airplane Structures and Testing*—Schwandt discussed various methods and procedures of structural static testing. His second talk was limited to possibilities of obtaining safer planes through better cockpit design. Lantern slides of various types of cockpit damage in aircraft accompanied the talk. Critical observations on the need and necessity for improved cockpit design were offered.

A discussion and question period concluded the meeting attended by 75 members.

Mississippi State College

Principal talk given at June 10 meeting of State College Branch was a paper written by Hugh DeHaven. Presiding was Harry C. Smith, Vice-Chairman.

Read by Robert E. Sizemore, Treasurer of the Branch, title of paper was "Greater Safety in Personal Aircraft." Meeting, attended by nine members, was held in the Engineering Building.

University of Tulsa

Members met twice in May, on the 7th and 23rd, to conclude Branch business for the term. In the meeting of May 23, a film, *Report on Jet Propulsion*, was shown, and the following officers were elected: William C. Burkitt, Chairman; Elgin A. Waterfield, Jr., Vice-Chairman. Election for position of Secretary-Treasurer was postponed until the fall meeting.

University of Washington

Final meeting of the spring quarter was held June 3 in Johnson Hall under chairmanship of Raymond B. Oliver. Thirty-five members were present to hear William Blatz, Aerodynamicist of McDonnell Aircraft Corporation, speak on "The McDonnell 'Phantom' " and see the Navy color film on the FD-1.

News of Members

Stewart Peter Adams is now Liaison Engineer, Engineering Department, Fairchild Aircraft Division, Fairchild Engine & Airplane Corporation.

George E. Allison resigned from N.A.C.A. and is on an extended tour.

Max P. Baker, formerly Assistant Chief Engineer, Waco Aircraft Company, now is Project Engineer, Inland Manufacturing Division, General Motors Corporation.

Richard S. Barker, former Stress Analyst, Hamilton Standard Propellers Division, United Aircraft Corporation, resigned to become Research Engineer, Aluminum Company of America.

Norman R. Beers who had been Associate Professor, Aerological Engineering, Postgraduate School, U.S. Naval Academy, Annapolis, is now Scientist—Meteorology, Brookhaven National Laboratory.

Arthur E. Chapman, Goodyear Sales Representative for Field Tests.

George M. Bode is Engineer, Aircraft Engine Research Laboratory, N.A.C.A. He had been with Engineering & Research Corporation as Experimental Engineer.

Louis J. Borges, Jr., is Flight Analyst, C.A.A., following active duty in Navy as Ensign.

Forrest Campbell, Jr., resigned from Eastern Aircraft Division of General Motors Corporation to join Byrnes Associates as Draftsman.

Harry A. Campbell is Project Engineer, Menasco Manufacturing Company.

Arthur E. Chapman was named sales representative for field tests being conducted by Goodyear Aircraft Corporation on company's amphibian.

Jagannah P. Chawla, former Senior Engineer, Flight Research Department, Cornell Aeronautical Laboratory, now is Research Assistant and Graduate Student in Department of Aeronautical Engineering, M.I.T.

Thomas A. Cheatham, Jr., is a Pilot with Pan American World Airways. He served as Flight Officer, Ferry Division, Air Transport Command, A.A.F.

William E. Crowell is Section Head, Aircraft Equipment Research Section, Cornell Aeronautical Laboratory.

Charles A. Culver, former A.A.F. Lieutenant, now is Instructor, Tucson Aviation Corporation. Prior to war service he had been Senior Detail Draftsman, North American Aviation, Inc.

Robert M. DeWitt is Assistant Project Engineer, Aeroproducts Division, General Motors Corporation; formerly was Stress Analyst, Edo Aircraft Corporation.

Lavon Couch Dodd resigned as Senior Electrical Layout Draftsman, Lockheed Aircraft, to become Research Engineer, Sun Oil Company.

Archibald John Ferguson was transferred from Durban, South Africa, to British Overseas Airways Corporation headquarters at Berkeley Square, London. New post: Technical Assistant to Superintendent of Engineering Organization.

Wilfrid A. Fierle, former Navy Ensign, now is Aeronautical Research Technician, University of Detroit.

Floyd Richard Fletcher is District Representative, White-Rodgers Electric Company.

J. F. Rabardy Floyd resigned as Chief of Aerodynamics, The Glenn L. Martin Company, to take post at Applied Physics Laboratory, Johns Hopkins University, as Engineer.

John Foster, Jr., was named Executive Editor of new *Aviation Week*, McGraw-Hill Publishing Company. Formerly was Managing Editor, *Aviation*.

Verne Clayton Frost is Structures Engineer, McDonnell Aircraft Corporation.

Lloyd Ray Gant is with Consolidated Vultee Aircraft Corporation as Liaison Engineer.

William J. Gough is Aerodynamicist with Northrop Aircraft, Inc.

Richard H. Hollrock, former Lieutenant A.A.F., now is Engineer, Aero Affiliates Inc.

Dr. Gabriel Horvay resigned as Research Engineer, McDonnell Aircraft, to take post in Engineering General Division, General Electric Company.

Ephraim Manassen Howard is Aeronautical Engineer, Aircraft Engine Research Laboratory, N.A.C.A.

Lester Israel, former Aeronautical Engineer with Curtiss-Wright Corporation, now is Aerodynamicist, Chase Aircraft Company, Inc.

Charles L. Janis resigned from The Glenn L. Martin Company to become engineer with Kaman Aircraft Company.

Leonard Kenger is Senior Stress Engineer, Republic Aviation Corporation.

Martin V. Kiebert, Jr., has been appointed a member of Sherman Fairchild & Associates, serving as consultant to clients on aircraft telemetering, instrumentation, stabilization, servomechanisms and remote control, radar, and radio techniques.

Howard Franklin Kirk, Jr., is Test Engineer, Aircraft Gas Turbine Division, DeLaval Steam Turbine Company. Formerly was Lt. (j.g.) U.S.N.

Towru Kobara is Draftsman, Thompson Products, Inc.

Joseph Korn resigned from Curtiss-Wright to become Junior Engineer, Chase Aircraft Company.

Edgar J. Krenz, former Lieutenant Colonel A.A.F., now is Staff Assistant, Manager, Maintenance Base, United Air Lines, Inc.

Jackson G. Kuhn, formerly with Kinner Motors as Chief Engineer, joined Los Angeles Scientific Instrument Company as Engineer.

William Lankin is Project Engineer, McCauley Corporation.

John I. Lerom, former Captain A.A.F., is with Safety Regulation Branch, C.A.A.

William S. Lieberman is Assistant Design Engineer, McDonnell Aircraft Corporation. Formerly was Ensign, U.S.N.

Curtis P. Liljengren resigned from Air Transport Maintenance Corporation to become President, Flight Equipment & Engineering Corporation, Miami, Fla.

P. W. Litchfield, Chairman of the Board, Goodyear Tire & Rubber Company, traveled via P.A.A. Clipper to Uitenhage, South Africa, to open company's newest overseas factory.

William M. Loupe, former Engineer with Taylorcraft Aviation Corporation, now is Senior Aerodynamicist, Goodyear Aircraft Corporation.

Lawrence J. Low is Research Aerodynamicist, Cornell Aeronautical Laboratory. Formerly was with Curtiss-Wright Corporation, Buffalo Plant.

Peyton M. Magruder, formerly Chief of New Design and Director of Commercial Sales for The Glenn L. Martin Company, has formed Aeronautical Consultants, Inc., with offices at 340 W. 57th St., New York, and at 1700 Eye St., N.W., Washington, D.C.

Joseph J. Mascuch, former President and General Manager of Breeze Corporations, is now in business as Consultant.

Joseph D. McCarthy, former Engineer with The Glenn L. Martin Company, is President, McCarthy Stamping Company.

William G. McLaughlin is Junior Engineer, Johns Hopkins University's Applied Physics Laboratory.

Roy G. Miller is Chief Engineer, East Coast Aeronautics, Inc.

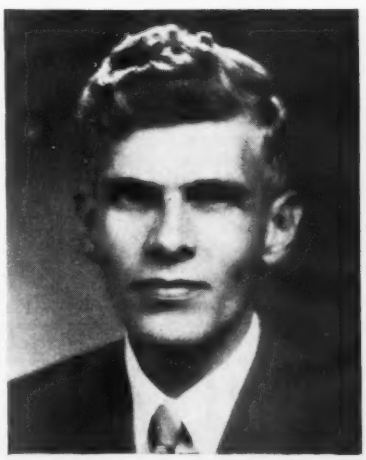
Raymond E. Moses, Jr., is Layout Draftsman, Firestone Aircraft Company.

William Numbers, formerly an engineer with Ranger Aircraft Engine Division is with Aircraft Components Service, C.A.A.

William A. O'Brien, former student of University of Michigan, is now Design Engineer, Bell Aircraft Corporation.

Edwin H. Olmstead is Mechanical Engineer, Eaton-Dikeman Company; formerly was with Jack & Heintz Precision Industries, Inc., as Project Engineer.

Peter J. Papadakos was named President, P. C. Helicopter Corporation.



George H. Woodard, Consulting Engineer.

Walter H. Pearson has formed new firm, W. H. Pearson and Son; was formerly Engineer with Kellett Aircraft Corporation.

Carroll J. Pierce, Jr., Chief of Aerodynamics, Boeing Airplane Company, Wichita, was appointed Director of Ohio State University School of Aviation by action of Board of Trustees.

William H. Pell is Research Associate, Brown University; formerly was Project Aerodynamicist, Bell Aircraft Corporation.

Elmore P. Pillsbury, Chief Aerodynamicist, Kaiser Fleetwings, Inc., resigned to become Senior Aerodynamics Engineer, Pilotless Plane Division, Fairchild Engine & Airplane Corporation.

Robert A. Price resigned from McDonnell Aircraft Corporation to become Research Engineer with Bell Aircraft Corporation.

Harry Samaras is Engineering Draftsman, Sikorsky Aircraft Division, United Aircraft Corporation.

Arthur Schnitt, Stress Analyst with Curtiss-Wright Corporation, Buffalo Plant, resigned to take post with Bell Aircraft Corporation as Structural Research Engineer.

William C. Schoen, former A.A.F. Lieutenant, now is Flight Test Analyst (Head of Data Reduction Group), Grumman Aircraft Engineering Corporation.

Earl Sherman is Test Engineer, Menasco Manufacturing Company, coming from N.A.C.A. where he was Junior Engineer, Aircraft Engine Research Laboratory.

Louis H. Shornick is in business as a Consultant.

Rudolf Soellner resigned from Kelly-Squiers, Inc., to become Design Engineer with Chrysler Corporation.

Max Sokol, formerly Chief Aerodynamicist at Columbia Aircraft Corporation, is now Project Engineer, Standard Aeronautical Index, Institute of the Aeronautical Sciences.

Reginald G. Standerwick, Engineer of General Electric Company's Aircraft Gas Turbine Engineering Division has retired after 38 years' service with the company.

Alan H. Stratford is Direct Costs Engineer, British European Airways Corporation; formerly was Aeronautical Technical Assistant, D. Napier & Son Ltd.

Gail H. S. Swan, former Chief of Structures, Kaiser Fleetwings, Inc., is Structural Designer, Chance Vought Aircraft Division, United Aircraft Corporation.

Jacob B. Swanson, Jr., former A.A.F. Lieutenant, is Engineer, Standard Oil Company.

Clem George Trimbach resigned from Curtiss-Wright Corporation to take post at Cornell Aeronautical Laboratory as Head, Development Engineering Department.

George H. Woodard, formerly Manager of Westinghouse Electric's Aviation Gas Turbine Division, has entered private practice as Consulting Engineer affiliated with Charles H. Welling & Co., Inc., 52 Vanderbilt Ave., New York.

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Members Elected

The following applicants for membership or applicants for change of previous grades were omitted from the July issue of the REVIEW because of space limitations. This list and the one immediately following include all applicants who have been admitted since publication of the list in the June issue.

Elected to Associate Fellow Grade

Soderberg, Carl Richard, S.B.; Professor of Applied Mechanics, Massachusetts Institute of Technology.

Transferred to Associate Fellow Grade

Alexander, Nicholas, Doctor's Degree; Professor of Aeronautical Engineering, Rhode Island State College.

Theodorides, Phrixos J., D.Sc.; Professor, Visiting Lecturer on Aeronautical Engineering, Harvard University.

Elected to MEMBER Grade

Bostwick, Herbert C., B.S. in M.E.; Flight Research Director, Sperry Gyroscope Co., Inc.

Brandewiede, Gregory Joseph, Director of Sales, Curtiss-Wright Corp.

Chapman, A. Howard, Chief Engineer, Kay Industries, Inc.

Crudge, Vernon G., Officer of the Order of the British Empire, M.I.T.; Manager, Atlantic Div., British Overseas Airways Corp.

Evans, John Henry, B.S.; Development Engineer, Bell Aircraft Corp.

Fisher, Lyman Carlyle, M.S. in M.E.; Asst. Chief, Mechanics Div., Research Dept., Naval Ordnance Lab. (Md.).

Fusfeld, Robert David, B.S.; Graduate Student, California Institute of Technology.

Gaiser, Forrest Eugene, B.S. in Ae.E.; Flight Test Engineer, Lockheed Aircraft Corp.

Gillette, Edmond Stephen, Jr., M.S.; Lt. Comdr., Asst. Chief Engineer, Naval Aircraft Modification Unit (Pa.).

Harrington, Robert Dennis, B.S. in Ae.E.; Aeronautical Engineer (P-3), Langley Mem. Aero. Lab., N.A.C.A.

Hawkins, William M., Jr., M.S.E.; Experimental Engineer in charge of Exp. Dept., Aircraft Engine Div., Packard Motor Car Co.

Hawthorne, Quintin Jay, B.S. in Ae.E.; Head, Dept. of Aero. Engineering, Tri-State College.

Jones, George Lester, M.E.; Works Aeronautical Engineer, Flight Inst. & Pilots, Sperry Gyroscope Co., Inc.

Kabase, Frank, M.S. in M.E.; Power Plant Analyst, Curtiss-Wright Corp.

Kahler, Ernest Louis, Jr., B.A. (Physics); Stress Analyst B, North American Aviation, Inc.

Kelley, James Bernard, M.S. in Applied Math.; Asst. Professor of Aero. Engineering, Postgraduate School, U.S. Navy (Annapolis).

Knapp, George P., M.S.; Project Engineer in charge of Development of Gas Turbine, Prop. Controls, Curtiss-Wright Corp.

Lewis, David S., Jr., B.S. in Ae.E.; Chief of Aerodynamics, McDonnell Aircraft Corp.

Matthews, Gordon Charles, B.A.; Research Engineer, Douglas Aircraft Co., Inc.

Mead, Lawrence Myers, Jr., C.E.; Structures Project Engineer, Grumman Aircraft Engineering Corp.

Mergen, Joseph Michael, B.S.; Project Engineer, Propeller Div., Curtiss-Wright Corp.

Middlewood, Robert William, B.S.; Project Engineer, Lockheed Aircraft Corp.

Neiswander, Robert South, M.S. in E.E.; Staff Engineer, Link Aviation Devices, Inc.

Parke, Darrel Beckman, Ae.E.; Project Aerodynamicst, McDonnell Aircraft Corp.

Rao, Pemmaraju Chalapati, B.Sc.; Postgraduate Student, Imperial College of Science and Technology (England).

Riley, Daniel Edward, B.Ae.E.; Chief, Special Aircraft Branch, U.S. Army Air Forces (Wright Field).

Roe, Robert B., E.E.; Flight Operations Manager, Flight Research Dept., Sperry Gyroscope Co., Inc.

Rogers, Donald Howard, Chief Test Pilot, A. V. Roe Canada Limited.

Rogers, Orville R., Ph.D.; Aeronautical Engineer, Chief–Special Projects Unit, Air Matériel Command (Wright Field).

Schneider, Raymond John, M.S. in Ae.E.; Lt. Comdr., Head of Fire Control Branch, Armament Div., Bur. of Aeronautics, U.S. Navy.

Schultz, Arthur B., B.S.E. (Aero.); Chief Engineer, All American Aviation, Inc.

Sheets, Herman E., Dr. of Technical Sciences; Section Head in charge of power plants, Goodyear Aircraft Corp.

Weichsel, Hans, Jr., B.S. in Ae.E.; Project Leader, Flight Research Dept., Cornell Aero. Lab.

Welanetz, Ludolph Frisch, Ph.D.; Assoc. Professor of Mech. Engineering, U.S. Naval Postgraduate School (Md.).

Whitehead, James Cameron, B.Sc.; Squadron Leader, Royal Australian Air Force.

Whittlesey, James Wright, B.S. in M.E.; Development Engineer, Gladden Products Corp.

Yusuff, Syed, M.Sc.; Lecturer, University of Mysore (India).

Transferred to MEMBER Grade

Arms, Richard Philip, M.S.; Flight Test Project Engineer, (Ohio Area), General Electric Co.

Ashkenas, Irving Louis, M.S. in Ae.E.; Chief of Aerodynamics, Northrop Aircraft, Inc.

Avgerenos, Alexander George, B.S. in Ae.E.; Engineering Designer, Consolidated Vultee Aircraft Corp.

Bajkowski, Frank Walter, B.Ae.E.; Stress Analyst "A," Aviation Maintenance Corp.

Beardsley, George Francis, M.S. in Ae.E.; Captain, Fiscal Dir., Bureau of Aeronautics, U.S. Navy.

Bentley, Edward Patterson, Sc.D. in Applied Physics; Vice-Pres. and Treas., Instrument & Devel. Labs. Inc.

Birnbaum, Arnold, B.C.E.; Design Engineer, Special Project Dept., M. W. Kellogg Co.

Bounous, Edwin Philip, B.S. in Ae.E.; Structural Designer, Grumman Aircraft Engineering Corp.

Bradfield, Walter Samuel, M.S. in Ae.E.; Project Supervisor—Aerodynamic Design, Applied Physics Lab., The Johns Hopkins University.

Brice, Philip E. R., B.S. in Ae.E.; Asst. to Chief Engineer, Republic Aviation Corp.

Britton, Sidney Leon, B.S. in Ae.E.; Design Engineer, Gas Turbine Engineering Div., A. V. Roe Canada Limited.

Burd, Edward, Jr., B.S. in Ae.E.; Aircraft Structural Designer, Northrop Aircraft, Inc.

Burns, Charles Evan, B.S. in Ae.E.; Sales Engineer, National Automotive Fibers, Inc.

Bush, Robert Gordon, B.Ae.E.; Field Service Representative, Boeing Aircraft Co.

Christenson, Charles Harold, B.Ae.E.; Consultant for Brazilian Aeronautical Commission.

Chvosta, Jerry Frank, M.S. in Ae.E.

Coleman, Thomas F., M.S. in Ae.E.; Research Lab. Analyst, Aerophysics Lab., North American Aviation, Inc.

Crosby, Frank Miller, M.S. in M.E.; Instructor, Purdue University.

Czarnecki, Kazimierz Roman, B.S. in Ae.E.; Aero. Research Scientist, Langley Mem. Aero. Lab., N.A.C.A.

Dickson, Preston Edward, Aerodynamics Engineer, Supervisor of Aerodynamics Section, Beech Aircraft Corp.

Dodge, Charles Hopkins, C.E.; Sr. Research Engineer, Jet Propulsion Lab., Guggenheim Calif. Inst. of Tech. Project, California Institute of Technology.

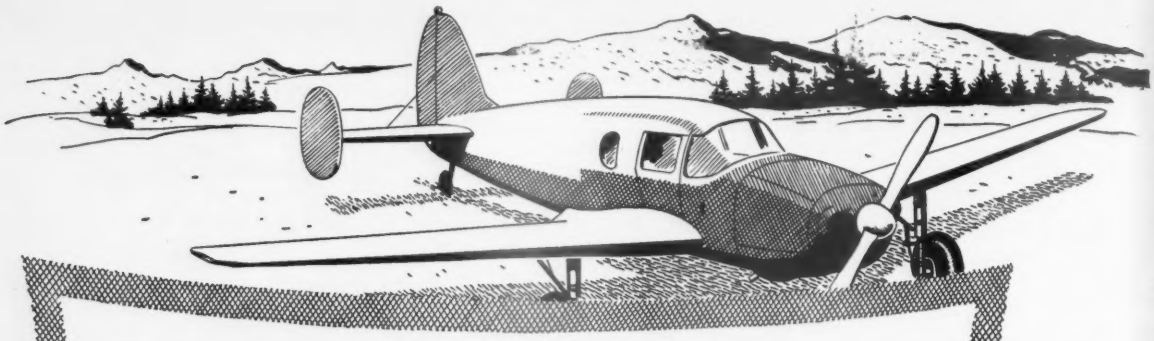
Drinkwater, William Dale, M.S. in Ae.E.; Instructor in Aeronautical Engineering, Dept. of Aeronautical Engineering, University of Notre Dame.

Fay, Joseph Patrick, B.A. in Physics; Tool Engineer, Republic Aviation Corp.

Fisher, James Lee, Jr., B.S. in M.E. (Aero Option); Sr. Designer-Aerodynamics Group, Goodyear Aircraft Corp.

Freedman, Gordon Lincoln, B.S. in Ae.E.; President and General Manager, Freedman Aircraft Engineering Corp.

Frost, Verne Clayton, S.B. in Ae.E.; Structures Engineer, McDonnell Aircraft Corp.



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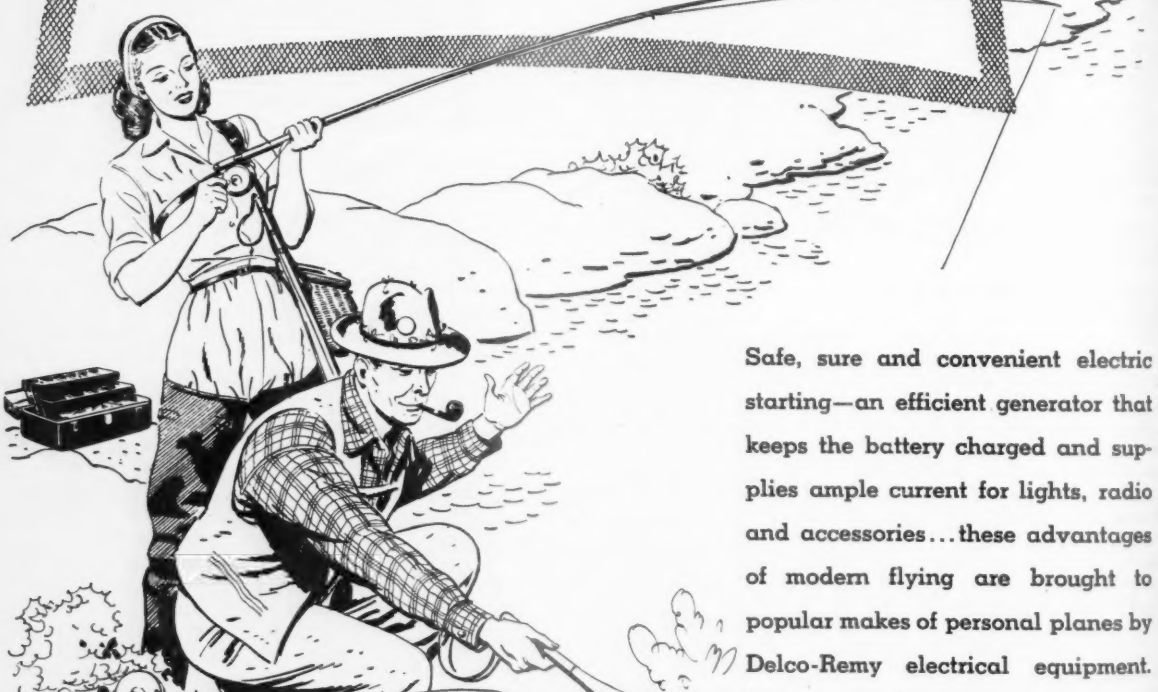

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Gardner, Ray David, Jr., Lead Engineer, Fuselage, Northrop Aircraft, Inc.

Goddard, Frank Eber, Jr., B.S. in Ae.E.; Design Specialist, Engineer in charge of Aerodynamic Research, The Glenn L. Martin Co.

Greenewald, Raymond Eugene, B.S. in Ae.E.; Structures Engineer, Composite Design Group of the Structures Section, Cornell Aero. Lab.

Hamilton, Robert Bradley, B.S. in Ae.E.; Liaison Engineer—Control System of Model 89 "Constitution," Lockheed Aircraft Corp.

Haynes, Benarthur Castle, M.S.; Chief Observations Section, U.S. Weather Bureau (Washington, D.C.).

Heimer, Harry James, Ae.E.; Aerodynamics Engineer, Hughes Aircraft Co.

Huber, John Richard, Project Engineer, Helicopter Research, Firestone Aircraft Co.

Jackson, Martin Alexander, Layout Designer, Wing Structures, The Glenn L. Martin Co.

James, Donald Liggett, Jr., B.S. in M.E. (Aero Option); Asst. Professor of Aeronautics, San Jose State College.

Joiner, Ernest Lee, Jr., B.S. in Ae.E.; Flight Test Engineer, Lockheed Aircraft Corp.

Judd, Frederick V. H., B.S.; Power Plant Technical Engineer, Republic Aviation Corp.

Kissel, Emil, B.M.E.; Flight Engineer, Pan American World Airways System (Atlantic Div.).

Knowles, Richard Cleveland, M.M.E.; Research Engineer, Aircraft Armament Dept., Sperry Gyroscope Co., Inc.

Lien, Wallace Addison, M.S. in Ae.E.; Engineering Test Pilot and Flight Test Project Supervisor, North American Aviation, Inc.

Longfelder, Harlowe Julius, Ae.E.; Aerodynamics Engineer, Boeing Aircraft Co.

Lowry, Wendell Willis, B.S. in Ae.E.; Aircraft Engineer (B), United Air Lines, Inc.

MacDougall, George Fulton, Jr., B.S. in Ae.E.; Asst. Head of Spin Section, Langley Mem. Aero. Lab., N.A.C.A.

Mahaffey, Phil Tyson, M.S. in Ae.E.; Stress Analyst, Consolidated Vultee Aircraft Corp.

Marquardt, Roy Edward, M.S.; President and Chief Engineer, Marquardt Aircraft Co.—Consultant, University of Southern California.

Mayerson, Chester Donald, B.Ae.E.; Chief of Structures and Test on Exp. Helicopter, Helicopter Consulting Forum.

McDonough, Charles Francis, B.Ae.E.; Development Engineer, Aircraft Engine Div., Packard Motor Car Co.

McLane, Philip William, B.S.E. (Aero Option); Engineering Designer, Special Projects Group, Lockheed Aircraft Corp.

Meins, Wallace William, B.S. in Ae.E.; Design Engineer, Design of Power Plant Instal. Exp. Group, Boeing Aircraft Co.

Metsger, Alfred Bowne, M.S. in Ae.E.; Commander—Head, Fighter Design Branch, Bureau of Aeronautics, U.S. Navy.

Misener, Walter Stuart, B.A.Sc.; Aerodynamicist, Gas Turbine Div., A. V. Roe Canada Limited.

Nial, John Augustus, B.Ae.E.; Aero. Engineer P-4, Flight Test Section, Naval Air Test Center, U.S. Navy.

Nickle, Ferril Rufus, B.S. in C.E.; Budget Officer, P-5, Ames Aero. Lab., N.A.C.A.

Nova, Robert Alberts, B.S. in Ae.E.; Engineer, Designer "B," Mech. Equip. Unit, Boeing Aircraft Co.

Parker, William Frederick, B.S. in Ae.E.; Engineering Designer "A," Preliminary Design Group, Consolidated Vultee Aircraft Corp.

Patterson, Raymond Thomas, B.S. in M.E. (Aero Option); Project Engineer, Supersonic Wind Tunnels, David Taylor Model Basin, Navy Dept.

Pheasey, Gordon Thomas, Field Service Repr. Navy Aircraft, Aircraft Service Corp.

Poorman, George Ellmaker, B.S. in M.E., (Aero Option); Aero. Engineer Design Research Div., Preliminary Airplane Design Branch, Bur. of Aeronautics, Navy Dept.

Richard, George Joseph, B.S. in M.E.; Stress Analyst "A," Northrop Aircraft, Inc.

Riedasch, Glenn Orville Nelson, Engineering Designer "B," Equipment-Armament Group, Boeing Aircraft Co.

Rosenbaum, Robert, A.M. (Physics); Project Stress Engineer in charge of Vibration and Flutter Group, Republic Aviation Corp.

Ross, Robert Simon, Ph.D. in Engineering, Asst. Prof. of Aero. Engineering; Univ. of Akron—Dir. of Guggenheim Institute.

Rossall, Chauncey Newkirk, Ae.E.; Asst. Project Engineer, Amphibian Project, Goodyear Aircraft Corp.

Rowley, Frederick Cannon, Engineering Test Pilot and Project Flight Test Engineer, Grumman Aircraft Engineering Corp.

Rumph, Lewis Benning, Jr., M.S. in Ae.E.; in charge of all aerodynamics activity of Airplane Div., Curtiss-Wright Corp. (Columbus Plant).

Sandroff, Paul Edwin, B.S. in Aero.; Research Engineer in charge of Structures, Theory & Devel. Group, Lockheed Aircraft Corp.

Scanlan, Robert Harris, Ph.D. (Math. and Physics); Chief, Dynamics Section, Airframe & Equipment Engineering Div., Aircraft & Components Service, C.A.A.

Schneck, Curtis Elias, B.S. in M.E. (Aero Option); Stress Analyst, Firestone Aircraft Co.

Serbin, Hyman, Ph.D.; Chief Aerodynamics Engineer, Fairchild Aircraft Div., Fairchild Engine and Airplane Corp.

Shepard, William Bowers, M.S. in M.E. (Aero); Project Engineer, Firestone Aircraft Co.

Shornick, Louis Harold, B.Ae.E.; Flutter and Dynamics Problems—Consultant.

Squires, John Clinton, B.Ae.; Aeronautical Designer and Consultant, Kelly-Squires, Inc.

Stevens, William Park, Jr., B.S. in M.E.; Aerodynamics Engineer, Structural Data, Stability & Control, Lockheed Aircraft Corp.

Struthers, John Hadwen, B.Ae.E.; Aerodynamics Engineer "A," Wind Tunnel Testing, Consolidated Vultee Aircraft Corp.

Sweet, Floyd Jerome, B.S. in Ae.E.; Major, Chief, Glider Projects, Aircraft Project Section, Engineering Div., A.M.C., U.S. Army Air Forces.

Taranek, Antoni, Group Leader of Fuselage, Structures Dept., Canadair Limited (Canada).

Tiedeman, Robert K., B.S.E. (Ae.); Asst. Project Engineer, Research Section, Propeller Div., Curtiss-Wright Corp.

Volbderding, Thomas Ray, B.S. in Ae.E.; Resident Engineer for Northwest Airlines at Boeing Aircraft Plant, Northwest Airlines, Inc.

Wahle, Jack Arthur, B.S.; Flight Engineer, Pacific-Alaskan Div., Pan American World Airways System.

Walkover, Louis J., B.Ae.E.; Sr. Design Engineer, Pilotless Plane Div., Fairchild Engine and Airplane Corp.

Wassell, Ralph Lowell, M.A. in M.E.; Col., Deputy Chief, Power Plant Lab., Hq., A.M.C., U.S. Army Air Forces (Wright Field).

Wendt, Harold Otto, M.Ae.E.; Project Aerodynamicist (on Army airplanes) Aircraft, Curtiss-Wright Corp.

White, Maurice Donald, B.S. in Ae.E.; Aeronautical Engineer, Engineering Project in Flight Research Section, Ames Aero. Lab., N.A.C.A.

Williams, Edgar Purell, M.S. in Ae.E.; Aerodynamics Engineer, Stability & Control Group, Douglas Aircraft Co., Inc.

Williamson, Melvin Edward, Technical Writer, Aviation Subjects, Technical Adviser to Petroleum Producers, Radio Writers and Motion Picture Industry.

Williamson, Merritt Alvin, Ph.D.; Director of Technical Research, Solar Aircraft Co.

Wosika, Leon Rice, B.S. in Ae.E.; Aerodynamicist in Preliminary Design Dept., Solar Aircraft Co.

Wright, Howard R. Jr., B.S. in Ae.E.; Lab. Instructor, Aero. Dept., Tri-State College.

Zeliff, Benjamin Sherman, Design Instructor, Design and Stress, Academy of Aeronautics.

Elected to Associate Member Grade

Abbott, Jack Gill, Design Engineer, Blanton & Cole.

Cheeseman, LeYork, Training Supervisor, Naval Aircraft Modification Unit.

Coronato, Angelo Albert, Development Engineer, Sikorsky Aircraft Div., United Aircraft Corp.

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Boonton, N. J.

Dumont, Theodore Edgar, Ae.E.; Project Engineer, Airframe & Appliance Engineering Div., Dept. of Commerce, C.A.A.

Emery, Donald Kenneth, Flying Instructor to Flying Club Members and Supervisor of Installation of Aero. Radio & Accessory Equipment, Self-Employed.

Fulkerson, Glenn Chandler, Flight Test Analyst A., Lockheed Aircraft Corp.

Gardinier, Harold Edward, Liaison Technical Class "A," Canadair Limited (Canada).

Gomez, Guillermo Gonzalez, B. of Eng.; Asst. Engineer in charge of Inspection and Design of Airport Bldg., Dirección General De Obras Publicas (Guatemala, C.A.).

Hardy, Rex, Jr., Asst. to Vice-President of Sales, Northrop Aircraft, Inc.

Hunter, William Thomas, Technical Specialist (Group Leader), Edo Aircraft Corp.

Kavanagh, Thomas Christian, M.B.A.; Instructor in Civil Engineering, New York University.

MacDonald, Kenneth Richard, Manager, Aviation Dept., San Francisco Chamber of Commerce.

Mulhern, Howard P., Aviation Representative, Standard Oil Co. of Pennsylvania.

Rabut, Edmond Charles, Electrical Design and Layout Engineer, Asst. Group Leader, Grumman Aircraft Engineering Corp.

Telesco, Lee Allan, A.B.; Lt. Col. Military Intelligence, G-2 Headquarters, 6th Army, U.S. Army Air Forces.

Tolomeo, Albert Joseph, B.S. in Ae.E.; Asst. Group Engineer (Body Group), Design and Layout of Structure, Sikrosky Aircraft Div., United Aircraft Corp.

Trout, Ray Gilbert, B.S. in Ae.E.; Asst Chief Engineer, L.C.N. Corporation.

Wildman, Richard E., B.S. in Ae.E.; Constellation Project Engineer, Trans World Airline.

Elected to Technical Member Grade

Andreoli, Douglas G., Flight Test Liaison Engineer, Chance Vought Aircraft Div., United Aircraft Corp.

Badger, David Matthews, B.S. in M.E.; Stress Analyst, Douglas Aircraft Co., Inc.

Busby, Keith, Ae.E.; Flight Lt., Engineer General, Royal Australian Air Force.

Colvin, Henry Fred, III, M.E.; Asst. Engineer, Aircraft Instruments, Kollsman Instrument Div., Square D Co.

Corbett, Marshall James, B.S. in Ae.E.; Ensign–Project Engineer, Tactical Test Div., Naval Air Test Center, U.S. Navy.

Hamrick, Joseph Thomas, B.M.E.; Draftsman "A," Douglas Aircraft Co., Inc.

Heuslein, William Aubrey, B.S. (Physics and Math.); Project Engineer in Flight Test Group, Grumman Aircraft Engineering Corp.

Hight, Richard William, Draftsman-Detailer, McDonnell Aircraft Corp.

MacGregor, Charles A., M.S.; Research Engineer, Engine Lab., Aircraft Engine Research Lab., N.A.C.A.

Transferred from Student to Technical Member

Auld, Charles D., B.Ae.E.

Barber, Robert Hardin, B.S. in Ae.E.

Bedwell, Lowell G., B.S. in Ae.E.; Flight Engineer, Goodyear Aircraft Corp.

Bland, William Marshall, Jr., B.S.; Student, North Carolina State College.

Bogiages, Paul Christos, B.Ae.E.; Engineer, General Electric Co.

Bradt, Robert Davidson, B.S.; Student, University of Maryland.

Carter, Ernest Purcell, B.S. in Ae.E.

Chesarek, Robert Francis, B.Sc.; Instructor of Mechanical Engineering, Carnegie Institute of Technology.

Copp, Martin R., B.Ae.E.

Cournyn, John Burton, B.S. in Ae.E.

Craig, Lawrence Edgar, B.Ae.E.; Aerodynamics Unit, Boeing Aircraft Co.

Dalley, Joseph Winthrop, B.S. in Ae.E., Student in Ae.E.; University of Texas.

Dzurenda, Thomas Joseph, B.Ae.E.

Ellis, Gaylord Orville, B.S. in Ae.E.; Engineer—Design Group, Curtiss-Wright Corp. (Columbus Plant).

Flatau, Abraham, B.S. in Ae.E.; Instructor, Aero. Engineering Dept., The Pennsylvania State College.

Gerber, John David, B.Sc.; Engineer, Aeroproducts Div., General Motors Corp.

Greenberg, David, B.S. in Ae.E.

Grigsby, Carl Edward, B.S. in M.E., (Aero Option); Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Hampton, Benjamin B., B.S. in Ae.E.

Harris, Robert Harding, B.Ae.E.; Engineer, General Electric Co.

Kuritzky, Marvin A., B.S. in Ae.E.

Lash, Billy Bray, B.S. in Ae.E.; Engineer, Design Dept., McDonnell Aircraft Corp.

Lynch, Howard Nelson, B.Ae.E.

McCall, Robert Elisha, Jr., B.Ae.E.; Field Engineer, Fairbanks, Morse & Co.

McCoy, William Justice, Jr., B.S. in M.E.; Jr. Engineer, Propeller Div., Curtiss-Wright Corp.

McLaughlin, Milton Donald, B.S.; Aero. Engr., Langley Mem. Aero. Lab., N.A.C.A.

Merrell, Richard Lind, B.S. in M.E.; Part-time Instructor and Grad. Student, Louisiana State University.

Monahan, Thomas Graham, B.Ae.E.

Mosquera, Jorge Armando.

Nolte, Arthur Carl, Ae.E.

Ostapenko, William Michael, B.Ae.E.

Parker, Arthur R., B.Ae.E.

Parvin, Richard H., B.S. in Ae.E.; Engineering Draftsman, Northrop Aircraft, Inc.

Peitzer, Herbert Elie, B.Ae.E.

Perry, Thaddeus Puzyrewski, B.S. in Ae.E.; Structures Engineer, Aircraft Div., Globe Corp.

Phillips, William Charles, B.S. in Ae.E.; Partner, Ferrous Press Works.

Sadowsky, Edward Julian, B.S. in Ae.E.

Sanders, John Lyell, B.S. in Ae.E.

Shrum, William Paul, B.S. in M.E.; Jr. Engineer, Fayette Engineering Co.

Smith, Harold Vincent, B.S.

Sonnemann, George, B.Ae.E.

Stevenson, Robin, S.B.; Aerodynamics Section, Goodyear Aircraft Corp.

Stumbaugh, Delmer Carl, B.S. in Ae.E.; Aeronautical Engineering Student, Indiana Technical College.

Torres, Oswaldo Fadigas, M.S. in Ae.E.; Aerodynamicist, Companhia Aeronautica Paulista, Sao Paulo, Brazil.

Tudela, Miguel, B.S. in Ae.E.; Lt., Peruvian Air Force (Peru).

Van Meter, James Tuttle, B.S.; Student Engineer, Massachusetts Institute of Technology.

Varteresian, Varteres A., B.Ae.E.; Apprentice Engineer, Chance Vought Aircraft Div., United Aircraft Corp.

Wadington, Wayne R., B.S. in Ae.E.

Weinstein, Maynard Irwin, B.S. in Ae.E.

Wintler, John Townsend, B.S. in M.E.

The following applicants for membership or applicants for change of previous grades have been admitted since the compilation of the preceding list.

Transferred to Associate Fellow Grade

Siltanen, John C., M.S. in Ae.E., Major, Asst. Chief of Rotary Wing Branch Aircraft Project Section, Engineering Div., A.M.C., U.S. Army Air Forces (Wright Field).

Elected to MEMBER Grade

Boyce, James Edward, Foreign Service Manager (European Locations), Lockheed Aircraft Corp.

Hall, Albert Henry, M.Sc. (Aero. Engineering), Asst. Research Engineer in Div. of Mechanical Engineering (Aeronautics), National Research Council (Canada).

Harris, Clarence William, B.S. in M.E., Project Engineer, Northrop Aircraft, Inc.

Lemmerman, Carl Walter, B.S., President, Industrial Sound Control & Homestead Corp.

Mayer, Waldemar F., M.E., Consulting Engineer, Garrett Corp. (AiResearch Mfg. Co.).

Mitchell, Wilbur Leonard, Ph. D., Aerodynamicist, Bell Aircraft Corp.

Perchonok, Eugene, B.S., Mechanical Engineer, Wind Tunnels & Flight Div., Aircraft Engine Research Lab., N.A.C.A.

Ring, Ian Hayward, Design Engineer, Commonwealth Aircraft Corp. Pty., Ltd. (Australia).

Vaughn, Stanley Irving, Jr., B.S. in M.E., Sr. Engineer, Flight Test (Airframes), Airplane Div., Curtiss-Wright Corp.

Transferred to MEMBER Grade

Abzug, Malcolm J., S.B. in Ae.E., Aerodynamicist, Douglas Aircraft Co., Inc.

Avery, Harold Tolman, A.B. in C.E., Chief Engineer, Marchant Calculating Machine Co.

Deland, Robert Earl, B.S. in Ae.E., Sr. Stress Analyst, The Glenn L. Martin Co.

Eikenberry, Robert Shaw, M.S.E. (Aero.), Assoc. Prof. of Aero. Engineering, Univ. of Notre Dame.

Eldridge, Robert A., B.S. (Aero Option), Stress Analyst, Douglas Aircraft Co., Inc.

Glenn, John Edward, B.S. in Ae.E., Lead Engineer, Designer "A," Controls Section, Engineering Dept., Northrop Aircraft, Inc.

Goran, Lenard Abraham, B.S. in M.E., Design Engineer, McDonnell Aircraft Corp.

Gulick, Beverly Grey, B.S. in C.E., Civil Engineer P-6, Flight Propulsion Research Lab., Aircraft Engine Research Lab., N.A.C.A.

Howland, Walter Lavern, Ph.D. in Ae.E., Flight Service Engineering Supervisor, Lockheed Aircraft Corp.

Kiefer, Eugene Peter, B.S. in Ae.E., Airplane Design Engineer, U.S. Army Air Forces (Wright Field).

Kreisler, Sol S., M.S. in Ae.E., in charge of Preliminary Design Unit (Long Beach Div.), Douglas Aircraft Co., Inc.

Larsen, Harold R., M.S. in Ae.E., Chief Engineer in charge of all Research & Engineering Development, W. & L. E. Gurley.

Laule, Gerald, Group Engineer, Supervising Checkers of Engineering Design, Lockheed Aircraft Corp.

Lenz, Ralph Charles, Jr., Ae.E., Aero. Engineer P-3, Flight Design Data Unit, A.M.C., U.S. Army Air Forces (Wright Field).

Moore, Richard Edward, B.S. in M.E., Sr. Engineer—Supervisor of Prop. Regulator Design, Aeroproducts Div., General Motors Corp.

Moy, Stanley, Ae.E., Supt. of Line Station Maintenance, Pacific Alaska Div., Pan American Airways System.

Murphy, Henry Thayer, B.S. in Ae.E., Mech. Engineer, Flight Propulsion Research Lab., Aircraft Engine Research Lab., N.A.C.A.

Pyle, Raymond Weiss, B.S. in M.E. (Aero Option), Flight Research Engineer, Ryan Aeronautical Co.

Robertson, Donald Ross, B.S. in M.E., Project Engineer, Experimental and Development Engineering, Sperry Gyroscope Co., Inc.; also licensed Professional Engineer, State of New York.

Senescall, Cleve Ridlon, Jr., B.Ae.E., Engineering Designer "B," Lead Engineer, Boeing Aircraft Co.

Slifer, Robert Lewis, B.Ae.E., Sr. Meteorologist, Mid-Continent Airlines.

Wiesner, Wayne, M.S. in Ae.E., Engineer, Manager Engineering Dept., United Helicopters, Inc.

Elected to Associate Member Grade

Chapman, John Trail, A.B., Librarian and Editor of *Airplane Pat. Digest,* Manufacturers Aircraft Assoc.

Farr, John Wesley, Jr., B.S. in Ae.E., 1st Lt., Pilot Training, U.S. Army Air Forces (Randolph Field).

Holmes, James Makepeace, Aircraft Inspector, C.A.A.

Montray, Carl Edward, Consultant and Designer, Aircraft Tire Service Engineering.

Preston, Thomas George, Technical Asst., British European Airways (England).

Weber, Louis Jacob, B.S. in Ae.E., Structural Analyst, North American Aviation, Inc.

Elected to Technical Member Grade

Holtby, Kenneth Fraser, Student, California Institute of Technology.

Kossar, Arnold Franklyn, B.Ae.E., Stress Analyst, Engineering Structures Group, Consolidated Vultee Aircraft Corp.

Owades, Henry Martin, Chief, Equipment Control, Transcontinental & Western Air, Inc.

Vollo, Samuel Donald, B.S. in Ae.E., Aero. Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Transferred from Student to Technical Member

Adleson, Irwin Joe, B.S., Engineering-Draftsman Class "A," Douglas Aircraft Co., Inc. (El Segundo).

Beckhart, Arnold Roy, B.Ae.E., Engineering Draftsman, The Glenn L. Martin Co.

Blackaby, James Rowley, B.S. in Ae.E., Engineer, Ames Aero. Lab., N.A.C.A.

Buckley, Robert James, B.S.

Compton, Philip Robinson, B.Sc., Trainee, Westinghouse Electric Corp.

Davis, Maurice Clarence, B.S. in Ae.E.

Fanger, Carleton George, B.Sc., Graduate Student, Oregon State College.

Goland, Leonard, B.S. in M.E., Student, Cornell University.

Gunn, William Angus, B.Ae.E., Instrument Flight Instructor, Jones Flying Service, Inc.

Guthrie, John McEllroy, B.S., Jr. Engineer, Pilotless Plane Div., Fairchild Engine & Airplane Corp.

Kelly, Alonzo Hyatt, Jr., B.Ae.E.

Knodel, David Charles, Ae.E., D. I. C. Staff, Massachusetts Institute of Technology.

Liner, George, B.Sc.

Nickols, Frank Andre, Jr., B.S., Aero. Engineer, David Taylor Model Basin, U.S. Navy.

Persh, Jerome, B.Ae.E.

Powers, Herman G., B.Sc.

Quartana, Joseph John, B.S.

Ramos, Lamor A., Jr.

Romano, Frank J., B.S.

Salonimer, Joseph Roger, B.Sc.

Schumacher, Paul, B.S. in Ae.E.

Twomey, Bernard Francis, Jr., B.S. in Ae.E., Flight Instructor, Lincoln Flying Service.

Volin, Robert Seymour, B.Ae.E.

Whitten, James Bruce, B.Ae.E., Engineer—Test Pilot, Langley Mem. Aero. Lab., N.A.C.A.

Necrology

Chet Eubank Sinclair

Chet Eubank Sinclair, former Secretary of the Institute who resigned January, 1943, to enter military service in the A.A.F., died June 17 in Washington, D.C. Mr. Sinclair had joined the staff of I.A.S. in 1933, less than a year following its organization. At the time of his death he was Staff Director of the Subcommittee on Procurement and Buildings of the House Committee on Expenditures in the Executive Departments.

Born at Hampton, Va., September 28, 1909, Mr. Sinclair attended the University of Wisconsin, College of Arts and Letters, and in 1931 went into the firm of Benjamin Howes, a building contractor and engineer in Scarsdale, and Pawling, N.Y. From October, 1932, until he came to the Institute, he was Secretarial Assistant at Polytechnic Institute of Brooklyn, Department of History and Economics.

In his 9 years at the Institute, Sinclair served as Assistant to the Secretary, Controller, and Secretary, succeeding Lester D. Gardner, who then became Executive Vice-President.

Following his release from active duty in the Air Forces in 1944, Sinclair became Senior Economic Analyst for the Justice Department. A year later he became Economist to the State Department's Division of International Resources and in May of this year started work in the House Subcommittee.

Edward Hall Faile

Edward Hall Faile, Consulting Engineer, died at his winter home on Jupiter Island, Fla., February 21. An Associate Fellow of the Institute, Mr. Faile was a highly qualified engineer who had been engaged in the designing and supervision of construction of engineering projects, including airports.

Born in New York City January 14, 1884, Mr. Faile received his M.E. from Cornell University in 1906. Among his numerous engineering and construction projects was the Rhode Island State Airport, Providence, of which he was in charge of design and construction as Consulting Engineer. In addition, he was Supervising Engineer during construction of the 32-story City Investing Building, New York City; Resident Engineer on construction of the Symington Malleable Iron Plant, Rochester, N.Y.; Chief Engineer in charge of construction of the 32-story Adams Building, New York City; and Supervising Engineer during construction of the 22-story Astor Trust Building in New York. During the first World War, Mr. Faile was Resident Engineer for the Emergency Fleet Corporation in charge of construction of the Submarine Boat Shipyard at Newark, N.J. Later, going into business for himself, he designed a 28-story office building at Broadway and Chambers St., New York City, for the Chemical National Bank and designed and built the eleven-story Goelet Building, Fifth Ave. and 49th St., also in New York.

Changes of Address

Since the Post Office Department does not as a rule forward magazines to forwarding addresses, it is important that the Institute be notified of changes in address 30 days in advance of publishing date to ensure receipt of every issue of the *Journal* and *Review*.

Notices should be sent directly to the Institute of the Aeronautical Sciences, 2 East 64th Street, New York 21, N.Y.

Sherman M. Fairchild Publication Fund Papers

As announced on page 7 of this issue, certain specialized papers are now available under the Fairchild Publication Fund program. Additional papers will be listed on this page each month as they are approved by the Editorial Committee and become available.

No.		Price*
100.	Blade Pitching Moments of a Two Bladed Rotor—R. W. Allen, Consulting Engineer—20 pp., 5 illus.	$1.00
101.	Introduction to Shock Wave Theory—J. G. Coffin, Kaiser Fleetwings, Inc.—84 pp., 20 work tables & charts. (July, p. 28)†	$3.50
102.	Electrical Resistance Strain Gages Applied to Wind Tunnel Balances—Elmer C. Lundquist, Department of Engineering, State University of Iowa—12 pp., 5 illus.	$0.80
103.	Performance Charts for the Turbojet Engine—Benjamin Pinkel and Irving M. Karp, National Advisory Committee for Aeronautics, Aircraft Engine Research Laboratory—60 pp., 23 illus. (March, p. 37)†	$2.20
104.	Tensor Analysis or Aircraft Structural Vibration—Charles E. Mack, Jr., Research Engineer, Grumman Aircraft Engineering Corporation—66 pp., 6 illus. (April, p. 28)†	$2.50

* A 25% discount on these prices is allowed to Institute Members.

† Indicates issue of REVIEW in which summary of paper appears.

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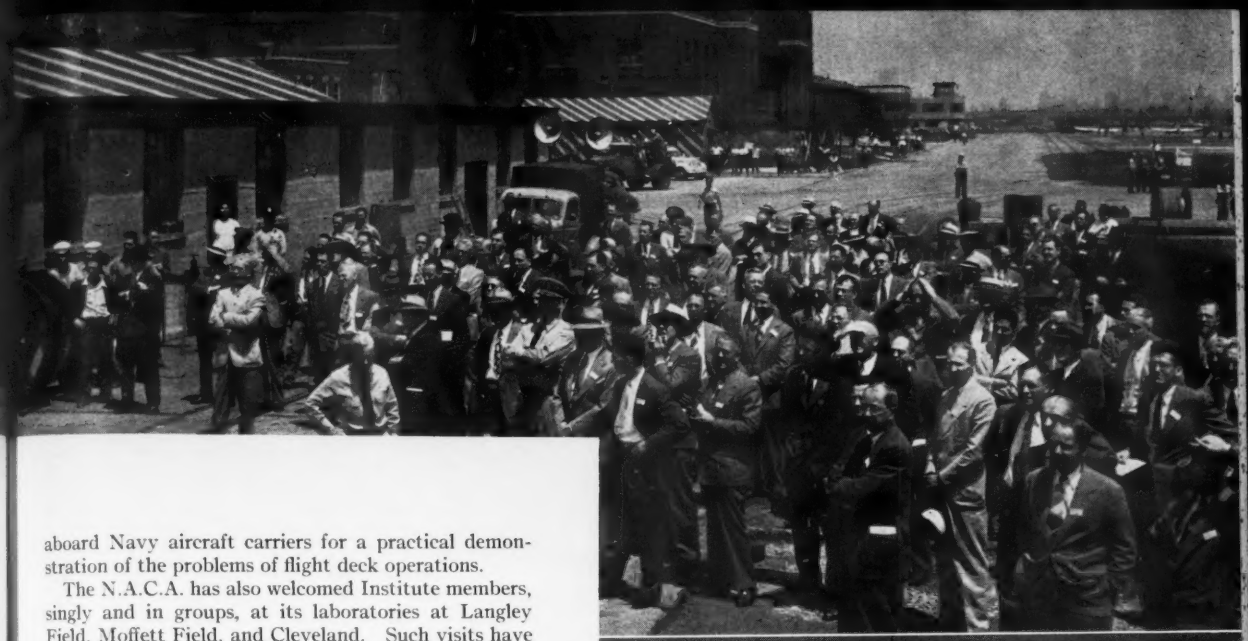
Editorial

"Bread and Butter" Letter

One of the most gratifying aspects of work of this organization lies in the extremely cooperative attitude of the technical branches of the Armed Services toward the Institute. Not only are many of the officers and civilian employees of the aviation activities of the Army and Navy among the Members and the Fellows of the I.A.S. (and, recently, the Institute has become a contractor to the A.A.F. to produce the *Standard Aeronautical Index*, as announced last month), but both Services have been most liberal in extending invitations to special groups within the membership to visit their activities ashore and afloat, to demonstrate to us what they are doing, and to discuss with us the problems of the moment. The pictures on these pages give some indication of the scope of such official visitations during the past year. The Army has been our Host at Wright Field and at Muroc; the Navy at Patuxent River, Johnsville, and League Island. Twice during the year, Institute groups have been taken to sea



aboard Navy aircraft carriers for a practical demonstration of the problems of flight deck operations.

The N.A.C.A. has also welcomed Institute members, singly and in groups, at its laboratories at Langley Field, Moffett Field, and Cleveland. Such visits have always been extremely interesting to those in attendance and have proved invaluable as a means of arriving at a clearer understanding on the part of the aeronautical engineer of the special problems facing military and naval technicians, pilots, and maintenance men.

We believe that the continuation of this form of joint activity is one of the most valuable services that the Institute can render its members, both individual and Corporate. We are glad to be able to report that this view appears to be shared by the several Governmental agencies involved. Plans are already under way for similar events in the future.

Although the amenities have been observed after each "tour," both by the Institute and by many of the individuals who participated, we should like to take this opportunity to acknowledge publicly our deep appreciation for the courtesies that have been rendered to the Institute by the officers and men of the Armed Services and the civilian agencies in connection with our visits to their establishments.

To them all, our hearty thanks, and a "Well Done."

S. P. J.

XS-1 Research Airplane

DEVELOPMENT OF THE XS-1 SUPERSONIC RESEARCH AIRPLANE

by R. M. STANLEY* and R. J. SANDSTROM†

Bell Aircraft Corporation

Introduction

EARLY IN DECEMBER, 1944, while the aircraft industry was still concentrating on the production of airplanes with which to end the war, the Army Air Forces discussed with the Bell Aircraft Corporation the possibility of designing a man-carrying supersonic research airplane whose tentative specifications included a minimum speed of 800 m.p.h. for 2 to 5 min. at 35,000 ft. or above and capable of carrying 500 lbs. of recording instrumentation. A decision was jointly reached that this airplane should adhere insofar as possible to a conventional arrangement in order to prove whether or not such an arrangement is practical at transonic speeds. Similarly, it was decided that relatively conventional methods of construction to conventional tolerances which could be duplicated in production aircraft would be employed. The experimental supersonic XS-1 airplane was the result.

Presented at the Aircraft Design Session, Fifteenth Annual Meeting, I.A.S., New York, January 28–30, 1947. Also presented at the Annual Summer Meeting, I.A.S., Los Angeles, August 7–8, 1947.

* Chief Engineer.

† Chief Preliminary Design Engineer.

It was immediately recognized that the many unknowns in this problem would necessitate probing every available source of information. A series of conferences was held with governmental agencies such as N.A.C.A., A.A.F., Bureau of Standards, Army Proving Grounds at Aberdeen, power-plant manufacturers, and institutions such as GALCIT. Many studies were made investigating various types of power plants including turbojets, ram-jets, and rockets and including unconventional configurations such as the Canard. (Information on the effects of sweepback was then quite fragmentary and its use was ruled out on those grounds.) Consideration was given to air launching and the use of skids for landing. However, possible tactical development of the aircraft dictated its being able to take off under its own power, and, hence, a tricycle landing gear was used. The ability to take off under its own power likewise ruled out any serious consideration of ram-jets (about which little was known at that time) as a possible power plant.

The XS-1 is of conventional configuration, having a wing area of 130 sq.ft., an aspect ratio of 6, and a wing loading at the beginning of its flight of 100 lbs. per sq.-ft. It is 31 ft. long and has a span of 28 ft. The pilot

is contained in a sealed cabin of ogive shape. Behind him within the fuselage are tanks carrying liquid oxygen and alcohol, feeding for 4.2 min. for a 6,000-lb. rocket motor mounted in the tail. At launching, it weighs 13,034 lbs., burns up over 8,000 lbs. of fuel, and lands weighing 4,818 lbs. at about 110 m.p.h.

It was anticipated that wing wake interference over the horizontal tail would present one of the greatest difficulties of transonic flight. For this reason the horizontal stabilizer was placed as high as was considered feasible above the wing wake and was made rapidly adjustable to accommodate large changes of trim. The control surfaces were made conventional and unboosted, since the small size of the airplane precludes the probability of unmanageable stick forces.

Power-Plant Selection

After reviewing the power-plant field, only the turbojet and the rocket were seriously considered. Preliminary studies indicated that an airplane designed around existing turbojets, using the thrusts given in the engine specifications, would not attain the desired speeds at the desired altitude. It was found that speeds in the region of only $M = 0.90$ could be obtained at sea level and altitude performance was considerably less. Turbojet manufacturers were then contacted on the possibility of increasing their engine outputs at altitude by 100 per cent or more for short periods of time by any means they could devise. The general reaction was one of great interest. However, little theoretical work and practically no testing had been done on thrust augmentation at that time, and the pressure on production models, brought on by the war, prevented any development on such a specialized project.

Consideration was then given to the combination of a turbojet and rocket power plant. The primary purpose of the turbojet was for take-off, climb to altitude, and return to the home base, while the rocket was to accelerate the airplane to, and maintain the desired speed after, the operational altitude had been reached. This combination resulted in an excessively large airplane. The turbojet performance fell off at altitude, resulting in a poor rate of climb, which in turn called for a large amount of fuel. The speed at which the airplane was flying when the operational altitude was reached was also low, requiring a considerable amount of rocket fuel for acceleration purposes. The use of two such widely different power plants also increased the installation and operational problems.

Although the fuel consumption of an all-rocket-powered airplane was high, the rate of climb was also high, averaging better than 20,000 ft. per min. between sea level and 35,000 ft., with a climbing speed of 500 m.p.h. Thus, the fuel required for climb was relatively low and that required to accelerate from climbing speed to the desired test speed was less than with a combination turbojet and rocket. At higher altitudes the potential climbing speeds and rate of climb were even higher, reaching maximum values of 120,000 ft.

Fig. 2.

per min. at an altitude of 120,000 ft., flying at nearly 1,400 m.p.h. After a comparative analysis of the design studies made around the various power plants, it was decided to proceed with the all-rocket-powered airplane.

Many propellants were considered before liquid oxygen and ethyl alcohol were selected. Hydrogen peroxide was discarded because the motors in operation at that time exhibited low specific impulses. It was available in this country only in limited quantities, and it must be handled with a great deal of care. Acid and aniline were not regarded as suitable for a man-carrying aircraft. These propellants are spontaneously combustible, and special precautions must be taken to keep them separated, since any dual leak in the air might initiate a disastrous fire. Acid is also injurious to personnel, which complicates the handling problem. Nitro-methane, being a monopropellant, would simplify the fuel system considerably, but it is subject to detonation under certain conditions which at that time were not too well understood. Although it was believed that nitro-methane had good possibilities, it was not felt that it had been developed to the point of reliability desired. Gasoline and liquid oxygen were studied, but with a regeneratively cooled motor it would have been necessary to carry a third tank containing water, since gasoline alone is not a suitable cooling medium.

The propellants selected, liquid oxygen and alcohol, are readily available, have a good specific impulse, are relatively safe and easy to work with, are not spontane-

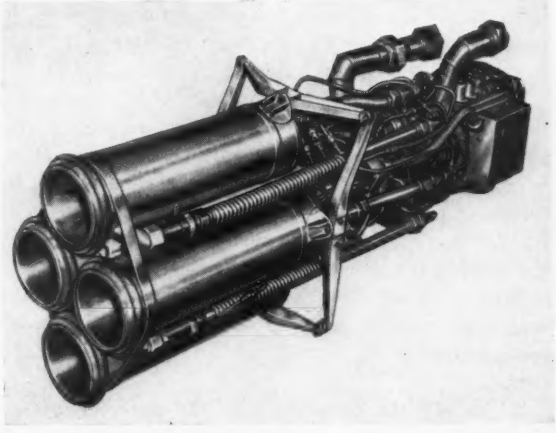


Fig. 3.

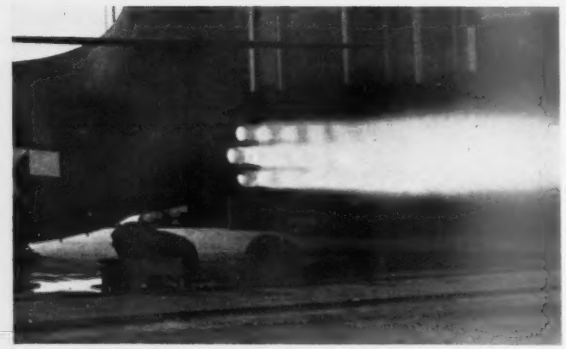


FIG. 4.

ously combustible, and are not injurious to personnel (small spatters of liquid oxygen are not harmful). The motor is regeneratively cooled by circulating the fuel through a cooling jacket before it is injected into the combustion chamber. To aid in cooling, one part of water is mixed with three parts of ethyl alcohol. It was found that the addition of this amount of water had a small effect on the overall impulse but aided appreciably in the cooling problem.

DETAIL DESIGN

The motor assembly, designed and built by Reaction Motors, Inc., consists of an assembly of four 1,500-lb. thrust rockets, operating at a chamber pressure of approximately 230 lbs. per sq.in.

Because of the high combustion temperature, approximately 5,000°R., and the relatively long time the motors must operate, some form of cooling was required. Injecting an excess of fuel to reduce the combustion temperature would have been inefficient; "sweat" cooling, in which the cooling fluid is forced through a porous combustion chamber and nozzle wall and vaporized, was just a gleam in someone's eye and has not progressed much farther up to the present time. Regenerative cooling with some film cooling is employed on this motor—that is, the fuel is circulated around the combustion chamber in a cooling jacket before being burned. In the region of the converging section of the nozzle where the hot gases impinge directly against the nozzle wall, the cooling problem is more difficult.

The rockets may be run separately or in combination as selected by the pilot. The motors are started by a small igniter located in the forward end of the cylinder, which ignites a stream of fuel and gaseous oxygen by means of a spark plug. When the chamber pressure reaches a value of approximately 50 lbs. per sq.in. the propellant valves open admitting the fuel and liquid oxygen. No provision has been made to throttle the individual rockets, and, hence, the pilot has at his command only 25, 50, 75, and 100 per cent of full thrust.

To supply the propellants to the rocket motor, a turbine-driven pump was specified. This mechanism was recognized quite early as being one of the items most likely to interfere with the early flight of the airplane, since it involved the development of a highly reliable piece of apparatus of a type hitherto unknown. To forestall probable flight delays, a temporary installation of pressurized tanks has been employed. This has reduced the airplane's endurance by about 1.5 min., has increased its landing weight by approximately 2,000 lbs., and has run the landing wing loading up to approximately 55 lbs. per sq.ft.

All the pressure tanks in this version of the XS-1 were designed to a factor of $1^1/_2$ above yield. The ultra-high-pressure nitrogen tanks were made from Great Lakes Alloy NAX 9120, varying in thickness from $^1/_4$ to $^5/_8$ in., depending on their diameter. The liquid oxygen tank was made from $^3/_{16}$ annealed stainless steel and the fuel tank from normalized 4130. Considerable trouble was experienced with the high-pressure joints in the fuel system. As a result, most joints are welded with as few high-pressure fittings as possible. Nitrogen gas is obtained commercially only up to 2,200 lbs. per sq.in., and we knew of no pumps that could deliver uncontaminated gas at the desired pressure. Our solution was a liquid nitrogen evaporator that converts liquid nitrogen into gas.

Referring to Fig. 5, the sphere located on top of the evaporator is 36 in. in diameter with a wall of stainless steel 3 in. thick cast in two halves and welded together. This sphere has been hydrostatically tested to 9,000 lbs. per sq.in.

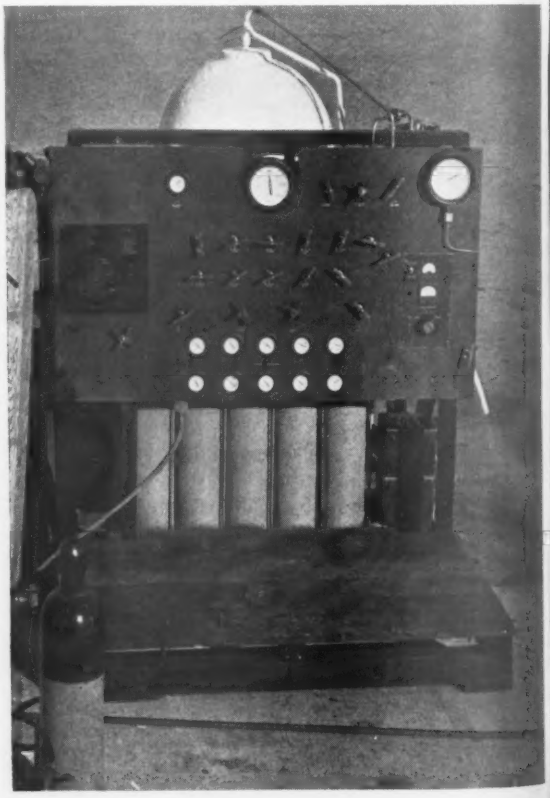


FIG. 5. Nitrogen evaporator.

During the testing of the evaporator we had an interesting experience. While operating the evaporator, it was noticed that particles of liquid dripped from the frosted lines in which flowed liquid nitrogen. This could not be condensed moisture because of the low temperatures of the lines, and it was baffling in view of the many pressure tests that had been made. It was finally discovered that liquid oxygen was being condensed out of the air on coming in contact with the cold nitrogen lines.

Structure

Structural design criteria were arbitrary and based principally upon ignorance. Since it was not possible to predict with any degree of certainty the loading distributions and possible buffeting in transonic flight, the airplane was designed to withstand 18 *g* ultimate.

Because the wing is thin, the thickness of its covering is unusual; it is slightly more than $^1/_2$ in. at the inboard end and machine-tapered to conventional thickness at the tip. This tapering process has not proved difficult for our shop to perform. Because of its heavy gage, the problem of local stiffening and preservation of reasonably accurate contour was simple. Some 240 pressure orifices and twelve strain gages are installed in the left wing with a similar quantity in the empennage.

The stabilizer construction is similar to the wing, and again provision has been made for the installation of alternate stabilizer shapes. As previously mentioned, the stabilizer itself is rapidly adjustable in pitch. The fuselage is conventional semimonocoque construction made from 24ST aluminum alloy.

With the supply of gaseous nitrogen aboard, a pneumatic auxiliary power system was employed. The landing gear and flaps are actuated by pneumatic cylinders, while the stabilizer is adjusted through a screw jack driven by a pneumatic motor. The system has proved itself entirely satisfactory.

The pilot's windshield does not protrude but conforms to the ogive nose shape of the fuselage. As a result, visibility during landing is marginal. The windshield is made of double thickness Plexiglas to prevent fogging; the intervening airspace between the two panels is dehydrated. (The pilot's exhalation is also dehydrated through a cannister built onto his oxygen mask.) It was desired to avoid the use of plate glass in the windshield because of the difficulties in producing double curvature safety glass. The increased potential flight speeds that have been gained by air launching, however, have made it mandatory that a new windshield be installed capable of withstanding elevated temperatures. As a result, plate glass is now being substituted for Plexiglas.

The pilot enters the cabin through a rectangular door on the right side of the fuselage, located in such fashion that in case of bail-out he is forced to go downward, thereby increasing his chances of missing the tail. His cabin pressure is sealed with him prior to launching,

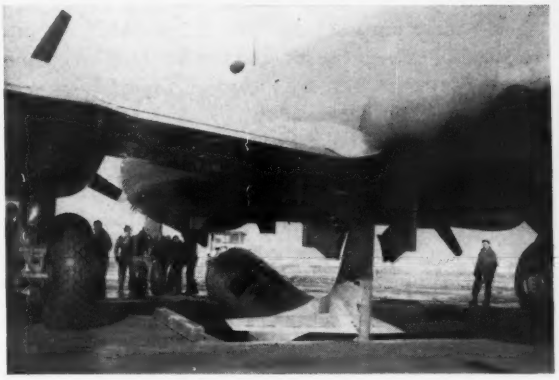


Fig. 6. Loading pit.

and no replenishment is necessary for a flight of this airplane's short duration. Internal cabin pressure is maintained at 3 lbs. per sq.in. above atmosphere, which is sufficient to maintain pilot safety irrespective of altitude. The cabin is tested to leak at a rate no greater than 1 lb. per sq.in. per hour at 3 lbs. per sq.in. internal pressure. We find this is actually conservative, since replenishment from the pilot's exhaled breath through his oxygen mask is appreciable.

A wheel control was chosen, rather than a stick, to permit the pilot's use of two hands effectively in case the need arose. A thrust-selector control, instrumentation switches, and emergency power shutoff are all located on the control wheel so that the pilot need not remove his hands during flight.

Flight Operations

The close of the war made available to us the B-29 originally desired, permitting air launching of the XS-1 with its resultant increase of operational safety. With a wing loading of 100 lbs. per sq.ft. and a large quantity of high-energy fuel aboard, the first few seconds after ground take-off would have been hazardous for the test pilot. This hazard is eliminated when his flight begins at a safe altitude thousands of feet above the earth, permitting him to jettison fuel prior to landing in case of engine failure or to bail out in case of more serious mishap. Almost equally attractive is the tremendous increase in potential performace resulting from launching the airplane with the high potential and kinetic energy which the B-29 can supply by virtue of its altitude and speed characteristics. The flight can now begin at a point that it previously would have reached only after the expenditure of better than half of its fuel; hence, the potential speed and altitude of the XS-1 are nearly doubled by this unique but highly practical method of launching.

A standard B-29 was supplied by the Army Air Forces. Its bomb doors were removed and the XS-1 was suspended from a standard Army Air Forces D-4 bomb shackle. An enclosed ladder was installed between the B-29 and XS-1 in such a manner that the XS-1 pilot or flight personnel could go back and forth between the two airplanes while in the air.

For loading purposes the XS-1 is lowered into a pit, the B-29 rolled over the pit, and the XS-1 pulled up and partially into the B-29 by means of a hoist located in the "mother" airplane.

It could not be predicted with certainty that simply dropping the XS-1 from the B-29 bomb bay would be successful. Accordingly, pressure surveys were made with the B-29 and XS-1 in flight, employing those pressure-sampling tubes already built into the XS-1 wing. These data indicated that a positive separating force existed. As a further precautionary measure, one of the B-29 bomb bay actuators was rigged up as an ejector to expel the XS-1 vertically, giving at the same time a slight nose-down pitching moment to insure a clean breakaway. In addition, a steel tube was pierced through the XS-1 fuselage ahead of the tank area, extending about 6 in. out on each side of the fuselage. Approximately 3 in. to the rear, slanting wooden guideposts were bolted to the B-29 to guide the XS-1 against backward drift and to prevent any tendency to yaw during the drop. Fresh red paint was smeared on the tube and the guide rails just prior to flight so that in case the latter functioned their usefulness would be proved.

The flight plan called for the initial drop to be made with inboard B-29 engines feathered and B-29 flaps at take-off position at 150 m.p.h. Subsequent flights would be made with the B-29 flaps neutral, inboard engines at low power, cruising power, then all engines at high power, with each succeeding flight going to higher and higher launching speeds; the behavior of the XS-1 was observed in each case. The craft was accompanied on all its flights by a "chase airplane," and all early flights were photographed both from cameras mounted on the wing and stabilizer tips of the B-29 and from the accompanying aircraft.

During February, 1946, ten glide flights under the foregoing plan were made at Pinecastle, Fla. This site was selected because Muroc Dry Lake is normally flooded at this season and 10,000 ft. runways were available at Pinecastle (actually only 3,000 ft. was ever required). The XS-1 was launched at approximately 27,000 ft. and glided to the ground in about 12 min., making a normal landing at a speed of about 110 m.p.h. Post-flight inspection revealed no fresh red paint and, hence, no interference. On subsequent flights it was found that the airplane could be safely launched from the B-29 entirely irrespective of the speed, power, or flap setting of the latter and without the aid of the ejectors or any form of guide rails. The XS-1 pilot had perfect control of his machine at all times during launching.

These glide flights were made with the airplane in its lightest possible configuration and were completed prior to the receipt of the rocket motor. Following the acceptance of the power plant and after extensive ground tests of the complete airplane, final preparations were made for power tests to be conducted at Muroc, Calif., where facilities were set up to handle this operation. A 15,000-gal. storage tank for liquid oxygen and a 3,300-gal. tank for liquid nitrogen were erected. A mixing tank for the alcohol and water was provided by reworking a small Army fuel trailer, and a loading pit was dug. Fig. 7 shows the XS-1 being loaded with fuel, oxidizer, and gaseous nitrogen.

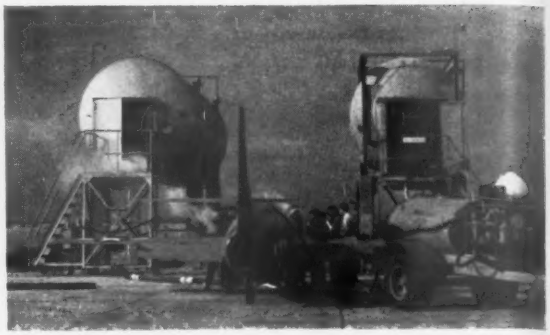


FIG. 7.

After four additional glide flights, during one of which a complete fuel load was jettisoned, the first powered flight was made. On December 9, 1946, in perfect weather, the XS-1 was launched at 27,000 ft. over Muroc Dry Lake. Approximately 10 sec. later, No. 1 rocket chamber was ignited, followed shortly by No. 2. The speed of the aircraft picked up so rapidly, however, that thrust was cut back to 25 per cent for reasons of safety, and a slow climb was made to 35,000 ft. The cabin noise level was reported to be low. At 35,000 ft., 50 per cent thrust was again applied, and a Mach Number of 0.79 quickly attained. All power was then shut down, the airplane glided down to 15,000 ft., and, with all four rocket motors running, 100 per cent thrust was applied during a brief climb. The pilot experienced extremely high accelerations, which he compared to those of a fighter during take-off employing water injection. On its first powered flight, the XS-1 reached a Mach Number of 0.795 during brief application of 50 per cent thrust, demonstrated satisfactory motor control and general handling characteristics, and adhered closely to the flight plan. The eleven subsequent flights have been equally satisfactory.

SUMMARY

The behavior of conventional airplanes at Mach Numbers above 0.8 is still largely unknown. The information heretofore received from actual flight tests has been generally based upon the reports of badly frightened pilots who, during dives from high altitudes, have encountered alarming loss of control of their machines. In a large portion of such cases the airplane has been completely out of control. It has derived its power principally from gravity, which naturally cannot be controlled by the pilot. Deprived of any means of effecting the reduction in speed which would give him safety and confronted with the ground rapidly rising to meet him, the pilot has not been in a position to do

(Continued on page 72)

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I.A.S. Briefs

Summaries of current papers received for publication or presentation at I. A. S. meetings

This Section gives advance and current information on papers presented to the Institute for publication or for presentation at meetings. Summaries of all pertinent papers, including those given at Section and Student Branch meetings, are published each month in these columns as rapidly as they are received from authors.

Many of these papers, after being processed by the Editorial Committee in the usual manner, will appear in full in later issues of the JOURNAL *or* REVIEW.

Some specialized papers will be made available through the Sherman M. Fairchild Publication Fund, as announced on p. 7 of this issue. For detailed information regarding papers immediately available, see page 19.

Study of Efficiency and Thrust of Conventional Turbojet Propulsor

By

B. Szczeniowski

University of Montreal

The problem of efficiency of turbojet propulsors may be treated from various points of view. The most important of these, however, seems to be the range of an airplane, dependent on the fuel consumption, on the one hand, and on the specific weight of the engine, on the other.

The thermal efficiency of a turbojet propulsor may be considerably improved by applying special systems with heat recuperation. A few such systems are already known and have been theoretically and experimentally investigated. The actual technical achievements in this field, however, hardly permit systems with recuperation to be applied in actual aeronautical practice. The heat exchanger usually becomes complicated and difficult to manufacture. It increases considerably the total weight of the engine, thus reducing the effect of accompanying increase in efficiency on the range, at least so far as short and medium flights are concerned.

It is, therefore, strongly advisable to exhaust all possible means to improve the conventional turbojet propulsor before other systems are applied. Fortunately, there are other ways to improve its efficiency. The first is to increase the maximum temperature in the cycle. However, the temperature actually attainable is limited by technological reasons to about 1,500° F., and it may be increased only by further improvements in the metallurgy of super-alloys applied here. The second way is to increase the compression ratio in the turbocompressor unit. This will result in an increase of the specific weight of the engine and may cause a decrease of the specific thrust obtainable, due to the limitation of maximum temperature—i.e., to the necessity of increasing the air excess. The main obstacle in applying this second solution is the fact that the best compression ratio to be chosen depends on the efficiency of both the compressor and the turbine. The higher these efficiencies, the higher may be the compression ratio which gives the best and highest overall efficiency.

The conclusion is that in a conventional turbojet engine considerable effort has to be made in improving, so far as possible, the efficiencies of compressor and turbine, and the compression or expansion (if in turbine) ratio obtainable from one stage in order to reduce the weight and bulk. The investigations made show how great is the effect of compressor and turbine efficiencies on the applicable compression ratio—i.e., on the overall efficiency, especially in the neighborhood of high efficiencies. Therefore, the problem of a conventional turbojet propulsor turns into the problem of improving both a compressor and a turbine design if the maximum temperature is to be limited.

Preliminary Design Studies: Piper Skysedan

By

Wallace J. Wilkie

Piper Aircraft Corporation

Subsequent to a specification submitted by the sales department, work was instigated on a new low-wing, four-place, metal airplane, the Piper Skysedan. Many specialized problems were solved by adequate compromise between practicality and theory.

Preliminary design of the fuselage was largely dependent on wind-tunnel tests in order to determine the greatest aerodynamic efficiency consistent with utility. Extensive mock-up studies of the cabin developed comfortable seating and reasonable c.g. limits, eliminating the necessity for loading placards.

Greatest utility was accomplished by means of a conventional gear which incorporates many of the advantages of tricycle gear, plus better small field handling.

The basic wing design, emphasizing both slow- and high-speed characteristics, culminated in a wing with a span no greater than the average light plane and a loading below contemporary airplanes of this class.

Use of a relatively large vertical tail to improve general flight behavior, particularly at slow speeds, has been confirmed by flight tests and by recently released N.A.C.A. reports.

The resultant prototype Skysedan has been proved by flight tests to be a safe, high-performance, utilitarian airplane.

Wing Flap with Reduced Moment

By

Alan Pope

Daniel Guggenheim School of Aeronautics, Georgia School of Technology

A 35.4 per cent chord, double-slotted flap was tested with the rearward 13.05 per cent reflexed 50°. $C_{l\,max.}$ was reduced thereby from 2.71 to 2.62, and the moment coefficient for the 60° flap at 0.9 $C_{l\,max.}$ was reduced from -0.715 to -0.518. Assuming an elevator power curve slope of -0.02, the reduction would correspond to a reduction of 9.8° of elevator, and assuming a wing loading of 40 lbs. per sq.ft., the landing speed would be increased from 80.0 to 81.4 m.p.h. Additional study would be required to obtain optimum reflex configuration.

LOSS OF SPIN OF PROJECTILES. Part I—Experimental Method

By

J. A. Van Allen

Applied Physics Laboratory, The Johns Hopkins University

A novel method is described for the measurement of the spin of projectiles throughout flight. The essential element of the method is a small rugged radio transmitter in the nose of the projectile with radiation pattern not symmetrical about the mechanical axis. Sample data are given. Applications are suggested.

LOSS OF SPIN OF PROJECTILES. Part II—Skin Friction Drag

By

H. P. Hitchcock

Ballistic Research Laboratories, Aberdeen Proving Ground

Analysis of the measured spin of ten types of projectiles leads to the evaluation of a skin friction drag coefficient which appears to depend on the shape of the projectile as well as on Reynolds Number. The average value of the skin friction drag coefficient is 0.00168.

Optimum Number of Webs Required for a Multicell Box Under Bending

By

George Gerard

Republic Aviation Corporation

In multicell construction, which may be used on the wing and tail surfaces of high-speed aircraft, the relatively thick compression surface is stabilized by a series of webs. It is necessary to determine the correct combination of number of webs and compression cover thickness which will result in the design of minimum weight.

Theoretical results are obtained in which the optimum number of webs is determined to be a function of only the structural thickness ratio. Nondimensional design charts are presented from which optimum conditions can be obtained. In addition to the study of optimum conditions, an investigation was made to determine the weight penalty involved in using a number of webs other than optimum. It was found that, for a slight weight penalty, it is possible to reduce the number of webs required and still maintain an efficient design.

Thermal Fin Effect in Heat Anti-Icing Corrugations

By

Julius Jonas

Northrop Aircraft, Inc.

The importance of thermodynamic detail design in heat anti-icing installations is stressed with particular reference to the design of chordwise inner skin corrugations. An analysis is made in an effort to evaluate the thermal fin effect contribution made by the inner skin corrugations. The results obtained emphasize the need for careful detail design of the chordwise inner skin corrugations so as to obtain maximum anti-icing potentialities for a given installation.

An Approach to Supersonic Airfoil Theory

By

W. E. Strohmeyer and D. R. Gero

Goodyear Aircraft Corporation

This paper presents a new approach to supersonic airfoil theory. The aerodynamic coefficients C_L, C_D, and C_M, commonly associated with Ackeret's theory, are obtained by making use of the fundamental energy equation. A comparison of theoretical with available experimental results is made to illustrate the limitations of the two-dimensional theory.

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Aeronautical Reviews

Aerodynamics

Supersonic Aerodynamics—Principles and Applications. Theodore von Kármán. (The Tenth Wright Brothers Lecture.) *Journal of the Aeronautical Sciences*, Vol. 14, No. 7, July, 1947, pp. 373–402, illus. Discussion, pp. 403–409. 191 references.

The aeronautical engineer requires a comprehensive theoretical synthesis of supersonic aerodynamics. This paper is an attempt to collect and correlate present knowledge into a systematic structure. Fundamentals such as the velocity of sound, the zone of action, the zone of silence, the rule of concerted action, and the fundamental differences between subsonic and supersonic motion are explained. Linearized theories of lift and drag are outlined which permit the Fourier integrals to be used in calculating the pressure distribution over a wing and the total value of the wave drag. The wave drag is calculated for normal straight wings with constant airfoil section, infinite uniform wings with sweepback, wings with finite aspect ratio, and for arrowhead wings. The use of the sweepback wing, the delta wing, and the mutual interference of the component parts of the aircraft are pointed out as means of eliminating wave drag. In the second portion of the paper the linear assumptions are modified to give an exact theory of supersonic flow. A theory for flow at transonic speeds is developed, and the interaction of shock fronts and the boundary layer is discussed. An extensive bibliography containing 191 items covers the literature published both in English and in foreign languages. The references are arranged under six headings: compressible fluids and general supersonic aerodynamics; linear perturbation theory, slender bodies and wings; flows with finite disturbances, hodograph method; boundary layer, viscous drag, and heat transfer; hypersonic motion and superaerodynamics; and nonstationary flows.

An Approach to Supersonic Airfoil Theory. W. E. Strohmeyer and D. R. Gero. *Goodyear Aircraft Corp.* (For abstract see "I.A.S. Briefs" on page 31 of this issue, August, 1947.)

Loss of Spin in Projectiles. I—Experimental Method. J. A. Van Allen. *The Johns Hopkins University.* **II—Skin Friction Drag.** H. P. Hitchcock. *Aberdeen Proving Ground.* (For abstract see "I.A.S. Briefs" on page 31 of this issue, August, 1947.)

Wing Flap with Reduced Moment. Alan Pope. *Georgia School of Technology.* (For abstract see "I.A.S. Briefs" on page 31 of this issue, August, 1947.)

Investigations at Low Speed of the Longitudinal Stability Characteristics of a 60° Swept-Back Tapered Low-Drag Wing. John G. Lowry and Leslie E. Schneiter. *U.S., N.A.C.A., Technical Note No. 1284*, May, 1947. 55 pp., illus. 4 references.

Investigation was made in the Langley 300-m.p.h. 7- by 10-ft. tunnel with a wing of aspect ratio 2.55. Several modifications made to this wing in an attempt to improve its longitudinal stability produced undesirably large changes in the longitudinal stability characteristics. The most effective modification was an alteration of the plan form of the wing obtained by extending the leading edge forward about half a chord length over the outer 25 per cent of the span. The maximum lift coefficient of the sweptback wing was about the same as that of the unswept wing, but the angle of attack for maximum lift was more than twice that of the straight wing. Decreasing the aspect ratio from 2.55 to 1 improved the longitudinal stability, particularly in the range of high lift coefficient. Tests with a deflectable tip showed little promise of improving the longitudinal stability, but deflecting the tip offered interesting possibilities of longitudinal and lateral control.

Investigation of Suction-Slot Shapes for Controlling a Turbulent Boundary Layer. P. Kenneth Pierpont. *U.S., N.A.C.A., Technical Note No. 1292*, June, 1947. 17 pp., diagrs. 3 references.

Tests of three types of boundary-layer-control suction slots were made at a velocity of about 100 ft. per sec. with a turbulent boundary layer which had a displacement thickness of 0.85 in. and a shape parameter of 1.8 in. Results of these studies indicate that the characteristics of the new boundary layer which is formed behind the slot is determined only by the quantity of air removed, provided that the slot inlet has rounded edges. Effectiveness near maximum is obtained when the rate of airflow removal is equal to the air which would pass at free-stream velocity through an area equal to the displacement thickness per unit span. Total pressure losses through the slot may be reduced by rounding the edges, inclining the slot, and slightly diverging the walls. Adequate width is the most important feature of a satisfactory slot. When the flow coefficient was 1.0 the total pressure coefficient for the best slot tested was 48 per cent less than that for a normal sharp-edge slot. For the best slot at flow coefficient 1.0 the total pressure loss in the boundary layer represented about 55 per cent of the measured total pressure coefficient.

Theoretical Studies on the Flow Through Nozzles, and Related Problems. K. O. Friedrichs, Charles R. DePrima, and others. *New York University, Applied Mathematics Group, Report No. 43 (National Defense Research Committee, Applied Mathematics*

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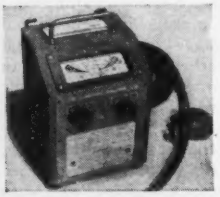

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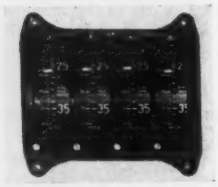

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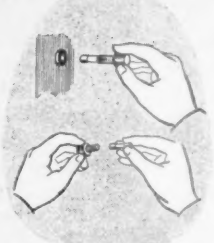

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Panel, Report No. 82.1R), April, 1944. 88 pp., figs. 27 references.

The customary one-dimensional treatment is refined to give a three-dimensional treatment. A simple formula for the thrust produced by such a flow is applied to widely divergent short nozzles. A method is given of obtaining the contours of a "perfect" nozzle, one that yields maximum thrust and a parallel exhaust flow for a prescribed expansion ratio. This method is applied to a reverse or compressor nozzle.

On Supersonic Compressors and Nozzles. K. O. Friedrichs, C. DePrima, and others. *New York University, Applied Mathematics Group, Report No. 77* (*National Defense Committee, Applied Mathematics Panel, Report No. 82.2R, Supplement to AMP Report No. 82.1R*), October, 1944. 13 pp., figs. 5 references. (Cf. preceding abstract.)

The method of designing a perfect nozzle given in *Report No. 82.1R* is worked out for a simple case. To check the accuracy of previous treatment of three-dimensional flow, terms of the third and fourth order are taken into account and the results compared with those obtained in the main report. The basic differential equations employed are derived in greater detail.

Remarks on the Mathematical Theory of Detonation and Deflagration Waves in Gases (Supplement to the Manual on Supersonic Flow and Shock Waves). *New York University, Applied Mathematics Group, Report No. 127,* (*National Defense Research Committee, Applied Mathematics Panel, Report No. 38.3R*), July, 1945. 45 pp., figs. 26 references. (Cf. AER 3/47:87.)

An analysis of the gas dynamical phenomena of one-dimensional flow involving detonation and combustion from the mathematician's point of view. A determinancy for gas motions which involve shocks only exists in the transition conditions together with the differential equations in the zones of continuity and the initial and boundary conditions. A different situation, however, presents itself as soon as "reaction fronts" occur, giving rise to the general problem: To what extent are reaction waves left undetermined by the laws of conservation? What are appropriate additional conditions to determine the reaction front? These questions refer to the determinancy of the solutions of the underlying differential equations satisfying well-defined transition, initial, and boundary conditions. While this discussion stresses the mathematical aspects of the theory, it may have physical significance in particular for the understanding of reaction processes taking place in gases which are in nonuniform motion.

The Flow of a Compressible Fluid Past a Curved Surface. Carl Kaplan. *U.S., N.A.C.A., Advance Restricted Report No. 3K02* (*Wartime Report No. L-320*), November, 1943. 78 pp., figs. 5 references.

Investigations on Laminar Boundary-Layer Stability and Transition on Curved Boundaries. Hans W. Liepmann. *U.S., N.A.C.A., Advance Confidential Report No. 3H30* (*Wartime Report No. W-107*), August, 1943. 64 pp., figs. 24 references.

The Axially Symmetric Flow A-4 for Mach Number 1.86 and 1.56. F. Schubert. (*Peenemünde, Heeresversuchsstelle, Archiv Nr. 66/101*, November 17, 1942.) *Cornell Aeronautical Laboratory*, Buffalo, 1947. 9 pp., figs.

A comparison of two methods that permit an approximate solution of the partial differential equation of the second order for rotationally symmetric potential flows. The method according to Sauer and that according to Tollmien might be said to be virtually identical at M-1.86 and M-1.56 when compared with the results of test measurements made on this missile.

Interference Method for Obtaining the Potential Flow Past an Arbitrary Cascade of Airfoils. S. Katzoff, Robert S. Finn, and James C. Laurence. *U.S., N.A.C.A., Technical Note No. 1252*, May, 1947. 55 pp., figs. 14 references.

The velocity distribution on each airfoil is considered to be the sum of that which corresponds to its presence in the interference flow. The interference is calculated from the velocity distribution on the airfoils so that the method reduces to an iteration process in which, for the first approximation, the interference is computed by assuming the free-stream velocity distribution to exist on each airfoil, and in subsequent approximations this velocity is corrected according to the interference derived in the preceding approximation. A solution is thus found for an arbitrarily specified angle of attack. This solution is used to find the conformal transformation to the circle and thence the solution of any other angle of attack.

Isolated and Cascade Airfoils with Prescribed Velocity Distribution. Arthur W. Goldstein and Meyer Jerison. *U.S., N.A.C.A., Technical Note No. 1308*, May, 1947. 50 pp., diagrs. 11 references.

An exact solution of the problem of designing an airfoil with a prescribed velocity distribution on the suction surface in a given uniform flow of an incompressible perfect fluid is obtained by replacing the boundary of the airfoil by vortexes. By this device a method of solution is developed which is applicable both to isolated airfoils and to airfoils in cascade. The conformal transformation of the designed airfoil into a circle can be obtained and the velocity distribution at any angle of attack computed. Numerical illustrations of the method are given for the airfoil in cascade.

Investigation of Effect of Span, Spanwise Location, and Chordwise Location of Spoilers on Lateral Control Characteristics of a Tapered Wing. Jack Fischel and Vito Tamburello. *U.S., N.A.C.A., Technical Note No. 1294*, May, 1947. 27 pp., illus. 13 references.

Curves are presented showing the variation of rolling-moment and yawning-moment effectiveness with spoiler span. The results indicated that the variation of rolling-moment effectiveness with spoiler span showed a trend similar to that of ailerons for a geometrically similar wing. This similarity suggests the possibility of employing aileron design data in the preliminary design of spoilers at low angles of attack.

Two-Dimensional Constant Velocity Ducts. N. J. S. Hughes. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2089*, December, 1944. 23 pp., figs. 3 references.

As an approach to the design of wing leading-edge air intakes, the determination of the shape of a two-dimensional duct for which the velocity is constant over the inner and outer surfaces is investigated mathematically. Calculations are made for ducts having horizontal and vertical axes of symmetry. The cases of constant-velocity airfoils and the duct of infinite length, and the application of the results to the design of wing leading-edge entries are also considered.

Non-Stationary Gas Flow in Ducts of Variable Cross Section. Josef Aschenbrenner. (*Forschung auf dem Gebiete des Ingenieurwesens*, Vol. 8, No. 3, May-June, 1937, pp. 118–130.) *Cornell Aeronautical Laboratory*, Buffalo, October, 1946. 20 pp., figs. 8 references.

The solutions for nonstationary gas flow in cylindrical ducts are extended to ducts of variable cross section. The differential equations for abrupt pressure changes in such ducts are derived, and a graphical-numerical approximation method is developed for calculating the pressure and velocity profile for arbitrary pressure differences and gas velocities, as well as for arbitrary cross-section profiles.

High-Speed Tests of a Ducted Body with Various Air-Outlet Openings. John V. Becker and Donald D. Baals. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. L-486)*, May, 1942. 14 pp., illus. 4 references.

Investigation of Air Flow in Right-Angle Elbows in a Rectangular Duct. Charles H. McLellan and Walter A. Bartlett, Jr. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-328)*, October, 1941. 17 pp., figs. 3 references.

Wind-Tunnel Investigation of Rear Underslung Fuselage Ducts. K. R. Czarnecki and W. J. Nelson. *U.S., N.A.C.A., Advance Restricted Report No. 3I21 (Wartime Report No. L-348)*, September, 1943. 67 pp., figs. 6 references.

Investigation of Slipstream Effects on a Wing-Inlet Oil-Cooler Ducting System of a Twin-Engine Airplane in the Ames 40- by 80-Foot Wind Tunnel. Dean R. Chapman. *U.S., N.A.C.A., Memorandum Report No. A5C10 (Wartime Report No. A-1)*, March, 1945. 30 pp., figs.

The Effect of Streamlining the Afterbody of an N.A.C.A. Cowling. George W. Stickle, John L. Crigler, and Irven Naiman. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. L-279)*, December, 1939. 20 pp., illus. 4 references.

Experimental and Calculated Characteristics of Several NACA 44-Series Wings with Aspect Ratios of 8, 10, and 12 and Taper Ratios of 2.5 and 3.5. Robert H. Neeley, Thomas V. Bollech, Gertrude C. Westrick, and Robert R. Graham. *U.S., N.A.C.A., Technical Note No. 1270*, May, 1947. 47 pp., illus. 4 references.

Investigation to demonstrate the correlation of wing characteristics obtained by calculation and by wind-tunnel tests in order to show some of the effects of aspect ratio, taper ratio, and root thickness-chord ratio on aerodynamic characteristics. The wing characteristics were calculated by an application of the lifting-line theory, which allows the use of the nonlinear section lift curves as well as the usual application of the theory that assumes linear lift curves. Comparisons made at equal values of Reynolds Number showed reasonable agreement between calculated and experimental wing force and moment characteristics. The method of calculation which allowed the use of nonlinear section lift curves gave better agreement with experimental values at high angles of attack than did the method that assumed linear lift curves. The values of maximum lift-drag ratio of the smooth wings increased with increasing aspect ratio throughout the range investigated, in spite of the increased drag of the thicker root sections associated with the higher aspect ratios. The maximum lift coefficients decreased with increasing aspect ratio, mainly because of the associated increase in root thickness-chord ratio.

Wind-Tunnel Investigation of the Effects of Surface-Covering Distortion on the Characteristics of a Flap Having Undistorted Contour Maintained for Various Distances Ahead of the Trailing Edge. Thomas A. Toll, M. J. Queijo, and Jack D. Brewer. *U.S., N.A.C.A., Technical Note No. 1296*, May, 1947. 64 pp., figs. 6 references.

Investigation of a modified NACA 65$_1$-012 airfoil having a 30-per cent airfoil-chord flap with contours simulating various distorted surface-covering shapes indicated that the effects of surface-covering distortion on lift characteristics generally are small when compared with the effects of surface-covering distortion on hinge-moment characteristics. Approximately 75 per cent of the effect of distortion on stick forces can be eliminated by maintaining the undistorted flap contour over the rear 20 per cent of the flap chord. When the flap has been thickened by distortion, opening the gap at the flap nose or placing transition strips near the airfoil leading edge generally causes the variations of hinge-moment coefficient with the angle of attack and with flap deflection to become less negative. Opening the gap generally has the opposite effect if distortion consists of a decrease in flap thickness. Variations in Mach Number from 0.20 to 0.40 have only small effects on the hinge-moment characteristics of the undistorted flap or of the undistorted flaps having the undistorted contour maintained over the rear 20 per cent of the flap chord.

Measurements in Flight of the Pressure Distribution on the Right Wing of a P-39N-1 Airplane at Several Values of Mach Number. Lawrence A. Clousing, William N. Turner, and L. Stewart Rolls. *U.S., N.A.C A., Advance Restricted Report No. 4K09 (Wartime Report No. A-13)*, April, 1945. 89 pp., figs. 4 references.

The irregularity of receipt of publications from abroad necessitates the review of articles in issues several months late. This is done to provide readers with information regarding foreign technical progress as soon as the issues are available in the United States.

The views and opinions expressed in this section are exclusively those of the writers or publications named. They are in no case to be construed as those of the Aeronautical Engineering Review or the Institute of the Aeronautical Sciences.

Wind-Tunnel Investigation of Profile Drag and Lift of an Intermediate Wing Section of the XP-51 Airplane with Bevelled Trailing-Edge and Contour Ailerons. Frank T. Abbott, Jr., and William J. Underwood. *U.S., N.A.C.A., Memorandum Report (Wartime Report No. L-615)*, January, 1943. 18 pp., illus. 3 references.

High-Speed Tests of Radial-Engine Nacelles on a Thick Low-Drag Wing. John V. Becker. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. L-229)*, May, 1942. 37 pp., illus. 3 references.

Maximum Lift Coefficients of Airplanes Based on Sum of Wing and Tail Areas. Herman O. Ankenbruck. *U.S., N.A.C.A., Restricted Bulletin No. L4C31 (Wartime Report No. L-556)*, March, 1944. 6 pp., tables.

Interference Effects of Longitudinal Flat Plates on Low-Drag Airfoils. Ira H. Abbott. *U.S., N.A.C.A., Confidential Bulletin (Wartime Report No. L-660)*, November, 1942. 13 pp., figs. 2 references.

A Method for Determining the Rate of Heat Transfer from a Wing or Streamline Body. Charles W. Frick, Jr., and George N. McCullough. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. A-40)*, December, 1942. 34 pp., figs. 10 references.

Investigation of the Variation of Lift Coefficient with Reynolds Number at a Moderate Angle of Attack on a Low-Drag Airfoil. Albert E. von Doenhoff and Neal Tetervin. *U.S., N.A.C.A., Confidential Bulletin (Wartime Report No. L-661)*, November, 1942. 19 pp., figs. 1 reference.

Calibration and Measurement in Turbulence Research by the Hot-Wire Method. László Kovasznay. (*A Műegyetem Aerodinamikai Intézetében Készült Munka*, Budapest, 1943.) *U.S., N.A.C.A., Technical Memorandum No. 1130*, June, 1947. 46 pp., illus. 12 references.

An electronic circuit for investigating turbulence by the hot-wire method. Formulas for the constants of the indicator and the circuits are developed. Oscillographic interpretation of specimen test results are given.

Theory and Application of Hot-Wire Instruments in the Investigation of Turbulent Boundary Layers. G. B. Schubauer and P. S. Klebanoff. *U.S., N.A.C.A., Advance Confidential Report 5K27 (Wartime Report No. W-86)*, March, 1946. 62 pp., illus. 13 references.

Jet-Boundary Corrections to a Yawed Model in a Closed Rectangular Wind Tunnel. Robert S. Swanson. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-603)*, February, 1943. 32 pp., figs. 7 references.

NACA Mach Number Indicator for Use in High-Speed Tunnels. Norman F. Smith. *U.S., N.A.C.A., Advance Confidential Report No. 3G31 (Wartime Report No. L-423)*, July, 1943. 10 pp., illus.

Interference Resistance of the Tail-Piece. Hoerner. (*Messerchmitt, Technische Berichte Nr. 64/42*, July 8, 1942.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 15/56T.* 13 pp., figs. 7 references.

A study of the increase in resistance resulting from the intersection of component surfaces with the tailpiece of an aircraft. The resistance of various tail-assembly designs is calculated. The presence of this resistance effect at the blade roots of a propeller is developed and the resultant loss of speed is computed.

Effect of Turbulence on Air-Flow Measurements Behind Orifice Plates. Jack N. Nielsen. *U.S., N.A.C.A., Advance Restricted Report No. 3G30 (Wartime Report No. L-274)*, July, 1943. 12 pp., illus. 2 references.

Air Laws and Regulations

The Proposed Multilateral Agreement on Commercial Rights in International Civil Air Transport. John C. Cooper. *The Journal of Air Law and Commerce*, Vol. 14, No. 2, Spring, 1947, pp. 125–149. 32 references.

Although this draft agreement provides for the general exchange of transit privileges, it does not allow preliminary fixing or arbitrary division of operating frequencies or capacities. It provides for the review of economic problems after negotiations have failed. However, in order to provide a basis for equality of opportunity and for sound and economical air transport operations, it would be better to agree on air routes bilaterally within the framework of the principles to be incorporated into the general agreement. The development of thought on the subjects of freedom of the air, routes, capacity, rates, and subsidies, from prior to World War I to date, is discussed.

Recent Trends in Domestic Airmail Rate Cases. E. Vanneman, Jr. *The Journal of Air Law and Commerce*, Vol. 14, No. 2, Spring, 1947, pp. 254–263. 60 references.

A review of the principles and rules that apparently guide the Civil Aeronautics Board in its mail rate decisions. Investigations of the Board into the financial, route, and operating conditions of Colonial, Northeast, and Chicago and Southern in order to determine ways and means of reducing need payments is important since it will supply comprehensive cost studies that heretofore have not been made because of lack of personnel and data. These studies will serve as a criteria for rate of return, investment base, and honest, economical, and efficient management.

Current Status of Aviation Law—American Bar Association Committee Report. *The Journal of Air Law and Commerce*, Vol. 14, No. 2, Spring, 1947, pp. 217–228.

This progress report of the Committee on Aeronautical Law is intended to indicate the work that has been done on law and legislation in the field of aviation and the work that needs to be done as shown by experience to date. The report is divided into five sections: international air transportation, federal jurisdiction over civil aviation, state jurisdiction over civil aviation, airport development, and aviation accident law.

The Aircraft Commander in International Law. Arnold W. Knauth. *The Journal of Air Law and Commerce*, Vol. 14, No. 2, Spring, 1947, pp. 157–169.

International air transport has developed to the point where it is necessary to establish laws defining the status of the aircraft commander. While it may not be necessary to give to him the extensive powers possessed by the master of a maritime vessel, stipulations must be made which will prevent the existence of these powers from depending solely upon the local laws for the 85 nations and 524 legislatures in the world.

Air Transport—General

Provisional International Civil Aviation Organization (PICAO). *The Journal of Air Law and Commerce*, Vol. 14, No. 2, Spring, 1947, pp. 229–234.

Report of the Seventh Session of the Interim Council held during the first quarter of 1947. The U.S. Department of State announced that the 26th instrument of ratification needed for ratification had been deposited and that the convention would become operative 30 days later, on April 4, 1947.

Multilateral Agreement on Commercial Rights in International Civil Air Transport—Proceedings of the Committee on Air Transport (Submitted Through the Interim Council) to the First Assembly of the International Civil Aviation Organization. *The Journal of Air Law and Commerce*, Vol. 14, No. 2, Spring, 1947, pp. 235–253.

Russia's Airline System. P. Crochet-Damais. (*Revue Générale de l'Air.*) *The Aeroplane*, Vol. 72, No. 1871, April 18 1947, pp. 391, 392, 393a, 393b, 395, illus.

The U.S.S.R. has depended almost entirely on air transport in penetrating her Arctic territories that lie north of the 60th parallel. Before 1922 meteorological research and exploration had been done by air. Ten years of research by the Leningrad Arctic Institute culminated in the polar expedition in 1937. From 1922 to 1928 the Junkers Co. of Germany built factories, organized and operated air lines, and trained personnel. In 1928, with the beginning of the first 5-year plan, foreign aid was dispensed with, and in 1932 a central authority for civil aviation was set up. By 1940 air lines had been extended and organized so as to be a substantial military asset. The war served as a further incentive and aircraft production was nearly quadrupled. Aircraft are used for fire patrol, pest control, and public health services, as well as for transportation. A map of the Soviet airways in 1940 shows an extensive coverage linking all the provincial capitals with Moscow. The total route mileage in 1946 is given as 100,000 miles.

Air Transportation, Its Status, Trends and Prospect. C. R. Smith. *The Journal of Air Law and Commerce*, Vol. 14, No. 2, Spring, 1947, pp. 150–156.

The original blueprint for air transportation as drawn up by Postmaster-General Walter Brown was made on a national scale. It attempted to group air routes into efficient operating units, air lines, and required that the operators have adequate

The Navy's XNQ-1 primary trainer, built by Fairchild, is designed to reduce pilot error to a minimum. New features incorporated in the plane include a functional safety cockpit, a retractable landing gear, flaps, and a Hamilton Standard constant-speed propeller.

capital to fulfill their responsibilities. Since 1934 these last two points have been abandoned, and, as a result, air carriers today are in financial difficulties that seem to be in direct proportion to the complexity and inefficiency of the routes over which they operate. The importance of American civil aviation not only at home but abroad makes it imperative that the air lines be assisted, but first there should be sound planning of routes and an attempt to correct past mistakes.

Foreign Challenge in the Air. Pat McCarran. *Aero Digest*, Vol. 54, No. 6, June, 1947, pp. 20, 21, 113, 114, 117, illus.

The three American air lines competing in the international air transport service cannot survive against unified, subsidized, foreign-flag lines. Only the establishment of a single consolidated company to replace the present U.S carriers will enable us to retain our lead in international air transport and permit us to bid in the world foreign market.

Air Transport, Cargo

What Part Shall Freight Forwarders Have in the Development of the Air Freight Industry? C. Allen Elggren. *The Journal of Air Law and Commerce*, Vol. 14, No. 2, Spring, 1947, pp. 170–213.

A history of express freight forwarding in the United States and a summary of the legal and juridical decisions affecting the extension of freight forwarding by air into the air-cargo field.

United States Foreign Trade: Trade by Air, January, February, 1947. *U.S. Bureau of the Census, Summary Report No. FT 971*, May 9, May 13, 1947. 6 pp.

Should Freight and Mail Be a Separate Operation from Passengers? Charles P. Graddick. *Preprint, S.A.E. Summer Meeting*, French Lick, Ind., June 1–6, 1947. 6 pp.

Airplane Descriptions

Navy Developing 400-Mph. Jet-Powered Flying Boat. Robert Hotz. *Aviation News*, Vol. 7, No. 20, May 19, 1947, pp. 7, 8, illus.

The Navy P5Y to be built by Consolidated Vultee Aircraft Corp. will be a 150,000-lb. flying boat. It will be powered by two prop-jet engines and will incorporate the planing tail hull design developed by the N.A.C.A.

Designed to Strike. *Flight*, Vol. 51, No. 2005, May 29, 1947, pp. 487–492, illus.

The Blackburn S.28/43 is a prototype of a British carrier based dive-bomber torpedo airplane. It is a single-place, low inverted gull-wing monoplane. The five-bladed propeller is driven by a 2,800-hp. Bristol Centaurus 59 engine. Wing span is 44 ft., 11.5 in. Each wing has three segments and folds toward the fuselage. Construction details are shown in cutaway drawings.

The Concordia: Structural Details of Cunliffe-Owen Light/Medium Feeder Liner. *Flight*, Vol. 51, No. 2005, May 29, 1947, pp. 496a, 496b, 497–500, illus.

A feeder-line, two-engined transport. The seating capacity is 10–12 passengers. The wing span is 57 ft. The two 550-hp. nine-cylinder Alvis Leonides LE4M engines are demountable and can be replaced in 40 min. Details of air-frame construction and the controls are given in cutaway drawings.

Percival Merganser: Details of the Layout, Construction and Equipment of Percival's 5/8-Seater Twin. *Flight*, Vol. 51, No. 2004, May 22, 1947, pp. 472, 472a, 472b, 473, 474, illus.

The Merganser, built by the Percival Aircraft Co., is a feeder-line, high-wing, twin-engined monoplane, powered by two D. H. Gipsy Queen 51 engines.

Essex Aero Sprite. *Flight*, Vol. 51, No. 2004, May 22, 1947, p. 467, fig. A proposed two-place, low-wing, all-magnesium monoplane having a V-tail. Wing span is 30 ft. It is powered by a Nuffield 100-hp. engine.

New 4-Place Dual Control Wheelair Takes to the Air. *Air Ads* (Royalton, Minn.), Vol. 3, No. 22, June 8, 1947, pp. 1, 5, illus.

The Wheelair 111A, designed by Puget Pacific Planes, Inc., is a four-place, dual-control personal plane. It is capable of 140 m.p.h. and has a range of 600 miles. It is spin-proof, stall-resistant, and has an automobile-type interior. Production is contemplated after testing of two prototype models.

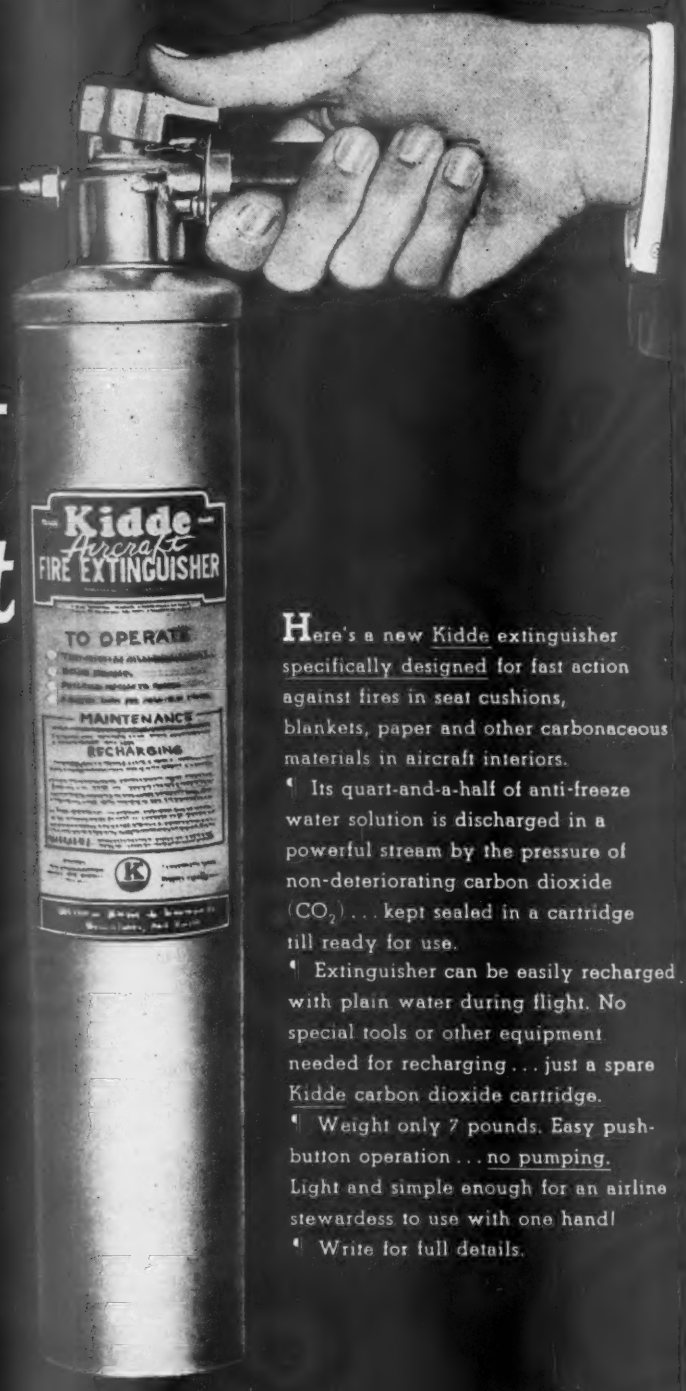
KZ-VII in the Air. *Flight*, Vol. 51, No. 2004, May 22, 1947, pp. 464, 465, illus.

The KZ-VII Lark, manufactured by the Danish Skandinavisk Aero Industri A/S is a four-place, personal monoplane, powered by a C.126 Continental flat-6 engine. Wing span is 31.5 ft.; cruising speed, about 110 m.p.h.; landing speed, about 35 m.p.h.; and range, 450 miles.

The Cessna 190 and 195. *Aero Digest*, Vol. 54, No. 6, June, 1947, p. 45, illus. (Cf. AER 7/47:39.)

Norecrin 1200 in the Air: Flying Characteristics of a Light French Sports Tourer. *Flight*, Vol. 51, No. 2005, May 29, 1947, pp. 501, 502, illus. (Cf. AER 1/47:40.)

Another KIDDE fire-fighting development



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Here's a new Kidde extinguisher specifically designed for fast action against fires in seat cushions, blankets, paper and other carbonaceous materials in aircraft interiors.

¶ Its quart-and-a-half of anti-freeze water solution is discharged in a powerful stream by the pressure of non-deteriorating carbon dioxide (CO_2) . . . kept sealed in a cartridge till ready for use.

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The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Kidde

Caproni-Campini Aircraft and Allied Developments in Italy. F. E. Pickles. *Combined Intelligence Objectives Sub-Committee, Item No. 5, File No. 12-24.* 80 pp., figs. British Information Services, New York. $2.20.

The original prototype jet airplane was examined. The power unit is an Isotta-Franchini liquid-cooled engine of 900 hp., driving a ducted three-stage fan having adjustable blades, combined with a ducted exhaust. Under certain conditions "after-burning" heat is added to the air stream prior to exhaust. Performance figures indicate that the jet power plant gave results inferior to those of a conventional airscrew unit. A twin-engined project for either a fighter or bomber utilized two Campini propulsion units in the wings powered remotely by engines housed in the fuselage; it apparently was not completed. A Campini gas-turbine project comprised a multistage centrifugal compressor with a multistage turbine driving a propeller; experimental work was done on individual parts, but a complete engine was not made. Another project involved converting an RE. 2005R fighter by installing an auxiliary Fiat engine to provide supercharging for the main engine and auxiliary jet power with after-burning for added thrust. Extensive analyses are given of the aircraft and equipment.

The Horten Tailless Aircraft. D. C. Appleyard and M. A. Biot. *Combined Intelligence Objectives Sub-Committee, Item No. 25, File No. 23–6,* May, 1945. 54 pp., illus. British Information Services, New York. $2.05.

Based on captured documents and interrogation of personnel, including a designer employed by the firm, descriptions are given in chronological order of the Horten types I through XII, with details of their special aerodynamic, structural, and mechanical features. Lists of the documents are appended, as well as information concerning the location and personnel of the establishments connected with the firm's activities, and other items incidental to the main purpose of the investigation.

Horten Tailless Aircraft. M. A. Biot and J. M. Jayne. *Combined Intelligence Objectives Sub-Committee, Item No. 25, File No. 19-2.* 30 pp., illus. British Information Services, New York. $0.90. Data concerning a jet-propelled tailless fighter designated H-IX-V2, plus short descriptions of the H-VIII flying-wing commercial craft and other Horten designs.

Natter Interceptor Project. C. B. Millikan. *Combined Intelligence Objectives Sub-Committee, Item No. 5, File No. 30-107,* July, 1945. 14 pp. British Information Services, New York. $0.55.

Design and construction details of an expendable, inexpensive, single-seater, rocket-powered interceptor, which is launched vertically, controlled by an automatic pilot in flight toward an enemy bomber, and guided to the target by the human pilot. It discharges a burst of rockets and dives away, the pilot parachuting to earth.

Airplane Design

Preliminary Design Studies: Piper Skysedan. Wallace J. Wilkie. *Piper Aircraft Corporation.* (For abstract see "I.A.S. Briefs" on page 30 of this issue, August, 1947.)

Optimum Number of Webs Required for a Multicell Box Under Bending. George Gerard. *Republic Aviation Corp.* (For abstract see "I.A.S. Briefs" on page 31 of this issue, August, 1947.)

Charts for the Minimum-Weight Design of Multiweb Wings in Bending. Evan H. Schuette and James C. McCulloch. *U.S., N.A.C.A., Technical Note No. 1323,* June, 1947. 39 pp., diagrs. 14 references.

A method of calculating the buckling stress of a multiweb wing. Design charts based on this method are developed for the minimum-weight design of multiweb wings of 24S-T aluminum-alloy sheet, extruded 75S-T aluminum alloy, and extruded 0-1HTA magnesium alloy. These charts make possible the design of the lightest wings of this type for a wide range of design requirements. An example of the use of the charts is given.

The Influence of Increased Engine Power on the Design of Fighter Aircraft. Hügelschäffer. (*Messerschmitt Report Me/Go/Ro/304,* March 5, 1943.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 15/225T.* 12 pp.

If the landing speed and the weight of the airplane remain constant, an increase in power yields increased speed, rate of climb, and ceiling. If the landing speed is kept constant and a weight increment is added which corresponds to the increase in power, then the speed, climb, and ceiling remain unchanged. If the wing area is held constant, an increase in power results in a decrease of ceiling if there is no weight increment. With constant wing area there is also a decrease in both ceiling and rate of climb if the weight factor is increased correspondingly. These considerations indicate that it is more economical to increase performance by improving airplane design than by changes in engine design.

The Application of Data on Strength Under Repeated Stresses to the Design of Aircraft. L. R. Jackson and H. J. Grover. *U.S., N.A.C.A, Advance Restricted Report No. 5H27 (Wartime Report No. W-91),* October, 1945. 40 pp., figs. 11 references.

Tests of Several Model Nacelle-Propeller Arrangements in Front of a Wing. James G. McHugh. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. L-510),* September, 1939. 31 pp., figs. 12 references.

Design of Sweptback Wings. J. E. Barfoot. *Aero Digest,* Vol. 54, No. 6, June, 1947, pp. 55–57, 134, 135, figs.

The design and construction problems presented by sweptback wings in the light of data obtained from German wind-tunnel tests at transonic and supersonic speeds.

Notes on the Shaft-Driven Pusher. Richard G. Naugle. *Western Flying,* Vol. 27, No. 5, May, 1947, pp. 16, 17, 34, diagrs.

This is a transitional design. The location of the propeller aft of the tail surfaces results in mechanical complexity, increases cost, and prohibits wide-scale production. It has the advantage, however, of giving the passenger the greatest comfort and accommodation and imposes no restriction on the placement of the wings. Development of this type may lead to a modified tailless aircraft that would combine the advantages of the conventional tractor and the pusher types.

High Wing Loading in Fighter Aircraft. H. Messerschmitt. (Augsburg, September 21, 1942.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 15/42.* 2 pp. A justification of the line of development followed by the German Air Force in sacrificing aircraft maneuverability for speed.

Airspeed Ambassador; Some Notes on the Design Considerations from Which This Advanced Medium-Category Trans-Continental Airliner Derives its Quality in the Fields of Safety, Economy, High Speed and Operating Efficiency. *De Havilland Gazette,* No. 17, February, 1947, pp. 6–8, figs. (Cf. AER 6/47:32.)

The "Power Wing" (All-Wing, Jet-Propelled Aircraft). A. Lippisch. *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 15/257T.* 5 pp. An abstract consideration of flight which leads to the ideal aircraft, a single wing, which is itself a Lorin-type power plant.

Aircraft—Paris Zone. John W. Logan and A. E. Woodward Nutt. *Combined Intelligence Objectives Sub-Committee, Item No. 25, File No. 4-7, 5-16.* 25 pp. British Information Services, New York. $0.90. Information gleaned from French engineers employed by the Germans in producing German aircraft during the occupation. The French were given only a minimum of information about German design trends and future plans.

Information on Messerschmitt Aircraft Design. L. E. Root. *Combined Intelligence Objectives Sub-Committee, Item No. 5, 25, File No. 32-37,* August, 1945. 6 pp. British Information Services, New York. $0.20. Views regarding tailless versus conventional aircraft design and the design of wings with sweepback.

Italian Aircraft Developments. Joseph V. Foa. *U.S., Field Information Agency, Technical, Final Report No. 240,* October 2, 1945. 16 pp., figs. British Information Services, New York. $0.55.

Summaries of the wartime work of various Italian scientists in aerodynamics, propellers, helicopters, and jet propulsion. Several German papers about helicopters are also reviewed.

Leading the Way. D. West. *Aeronautics,* Vol. 16, No. 3, April, 1947, pp. 26–35, illus.

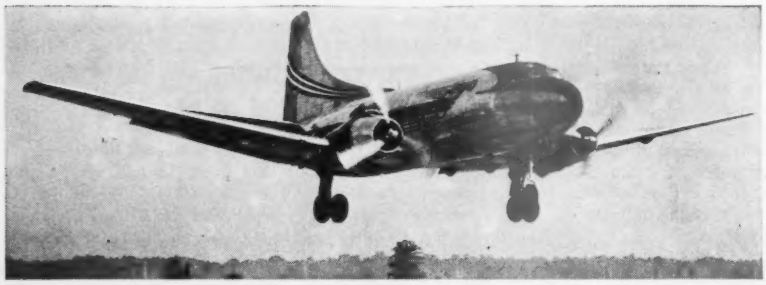
The King's Flight, which left England for South Africa in February, 1947, consisted of four Vickers Viking aircraft. One of these airplanes was modified to serve as a maintenance and repair unit. This Vickers Viking VL-248 provided stowage for sufficient parts and equipment, tools, and test equipment to service four aircraft for several months, in addition to allowing comfortable accommodations for the ground crew. A cutaway drawing shows the location of the various pieces of equipment and the "shoe-bag"-type spare-parts racks.

Observations on the Improvement in Vision Brought About by the Application of a Rain-Repellent Lacquer on an Airplane

Martin Memo

Published by The Glenn L. Martin Company

Baltimore 3, Maryland

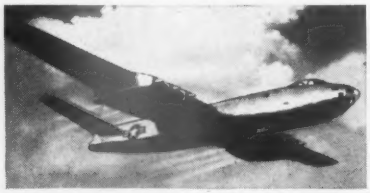


Toughest Test Yet . . . After having flown a distance greater than three times around the world during early flights and on CAA tests, the new Martin 2-0-2 was subjected to a grueling accelerated service test. First of its kind, the test consisted of a series of flights carried out under actual airline operating conditions. It covered a nation-wide network of more than 18,000 miles and included landings at more than 50 different airports. By meeting the varying extremes of altitude, weather and airport facilities encountered, the 2-0-2 offered further proof that it is America's top twin-engine airliner.

Pilot's Third Arm . . . The revolutionary new automatic propeller feathering system, developed for use on the Martin 2-0-2 and 3-0-3, permits, for the first time, full take-off weights and maximum operating economy on a twin-engine airliner. Thoroughly tested, this latest Martin development assures top performance during complete or partial engine failure on take-off. The system, in effect, feathers the propeller when the windmilling drag exceeds the thrust and at the same time cuts off the fuel booster pump. Pilots can easily over-ride the automatic system if they desire. Operators will benefit directly, as the use of the automatic feathering system allows greater take-off payloads.

Keep Our Air Arm Strong . . . The American Legion's intensive Air Power educational program is bringing to the American people the knowledge that Air Power is Peace Power and that without air power there can be no security for the nation. In a statement to members of the American Legion, Paul H. Griffith, National Commander, stated in part, "The destiny of the United States and the world today rests on air power. America must be kept first in the air." To keep America first we must continue our advanced aviation research and maintain an aircraft industry capable of rapid expansion in an emergency.

AIR POWER IS PEACE POWER



Look What's Up . . . The new Martin XB-48, latest pride of the Army Air Forces, gets a powerful push from its six jet engines . . . zips along at extremely high speeds . . . is the largest conventional multi-jet plane yet constructed . . . pioneers a new bicycle-type landing gear developed by Martin for our AAF. After its first flight on June 22, the XB-48 made its next three flights during the following week. An exceptional record for most newly designed planes, but not for a Martin plane. For example—the Martin 2-0-2, which made its second flight 15 hours after its first, had a record of nearly 100% availability during the rigorous testing period.

Zip, and They're Up . . . Thousand one, thousand two, thousand three, thousand four . . . it takes four seconds to read that aloud and that's all the time it takes for the landing gear of the Martin 2-0-2 to retract. Exact figure is 3.9 seconds. This quick reduction of drag at take-off is an added safety factor, and enables the 2-0-2 to reach its high cruising speed faster.

Faster, Express-Speed Schedules . . . on short-haul runs are possible with the Martin 2-0-2. This speedy airliner cruises 100 m.p.h. faster than the planes it supplants. This extra speed enables operators to cut schedule time by ⅓—build passenger acceptance—get more trips between inspections. In short, the new 2-0-2 cuts costs, builds profits for airlines.

Slip 'Em In . . . No tear-down is necessary to inspect or replace the Martin 2-0-2's Mareng fuel cells. Easily installed or removed through especially designed hatches (above), these flexible cells provide safe, dependable storage for the 1030 gallons of gasoline carried by the 2-0-2. And being flexible, the two tanks (each consisting of four inter-connecting Mareng cells) are less likely to rupture when subjected to continuous vibration or excessive stresses and strains. Intricate corner assemblies, excessive riveting and troublesome metalwork are eliminated.

New Wings for the World's Airways . . . Modern Martin 2-0-2 luxury liners offer new standards in speed, comfort and dependability . . . carry 36 to 40 passengers at speeds 100 m.p.h. faster than the planes they supplant. Air travelers and shippers will gain more time than ever before when they fly and ship in Martin transports on leading airlines. First deliveries on the new Martin 2-0-2 are to Northwest Airlines, with deliveries to follow to other North and South American airlines.

Martin AIRCRAFT

Builders of Dependable Aircraft Since 1909

Windshield. William H. McAvoy and Lawrence A. Clousing. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. A-58)*, May, 1942. 7 pp., illus.

Airports

Airport Design Blends with Ground and Air Engineering. Charles Froesch. *SAE Journal*, Vol. 55, No. 6, June, 1947, pp. 33–36, figs. (Extended abstract of a paper: The Planning and Engineering of Airports.) The physical and commercial factors that should determine the location, size, and design of an airport.

Landing Fee Standards. John H. Frederick. *Southern Flight*, Vol. 27, No. 6, June, 1947, p. 26.

Brief for the Airport Manager. Alexander M. Weir. *Aero Digest*, Vol. 54, No. 5, May, 1947, pp. 63, 146, 148, illus.

Light the Small Airport. A. H. Clarke. *Airports*, Vol. 11, No. 5, May, 1947, p. 17, illus. A discussion of the lighting equipment required for a small airport.

Asphalt Runway Construction. J. J. Smith. *Airports*, Vol. 11, No. 5, May, 1947, pp. 24, 25, illus.

Airways and Traffic Control

Blueprint for Future Airways. *Aero Digest*, Vol. 54, No. 6, June, 1947, pp. 35–37, 132, diagrs.

An air-traffic flow system proposed by the Air Transport Association of America to regulate the traffic density at airport approaches. The air lanes are divided into arbitrary signal blocks. Electronic indicators advise the pilot of traffic conditions ahead, and air-ground contact permits the revision of the navigation plan to accommodate approach-traffic density.

ATA Plans New Airway System. *Western Flying*, Vol. 27, No. 5, May, 1947, pp. 18, 19, 34, diagrs. (Cf. preceding abstract.)

Urge Integrated Landing Aids. Ray D. Kelly and Robert L. Champion. *SAE Journal*, Vol. 55, No. 6, June, 1947, pp. 41–43, illus. (Abstract of a paper: Integrated Landing Aids.) (Cf. AER 6/47:36.)

Landing Aids for an Integrated Landing System. *Shell Aviation News* (London), No. 106, April, 1947, pp. 7–9, illus.

From tests conducted at the Landing Aids Experiment Station at Dows Prairie, Calif., it has been determined that the most reliable method for landing aircraft under conditions of low visibility must involve the use of three landing-aid systems: radio aids, such as the Instrument Landing System or a Ground Controlled Approach system; high-intensity approach and runway lights to aid in establishment of visual contact with the runway; and high-pressure fog dispersal (FIDO) equipment.

The Case of GCA and ILS. Ralph Brown. *Airports*, Vol. 11, No. 5, May, 1947, pp. 21, illus.

Comfort in Aircraft

Air Conditioning of Pressurized Aircraft Cabins. Bruce E. Del Mar. *SAE Journal*, Vol. 55, No. 5, May, 1947, pp. 54–60, diagrs. (Excerpts from a paper: Analysis of Transport Aircraft Cabin Air Conditioning Requirements with Special Reference to Air Freshness, Temperature, and Humidity Control.)

A study based on the sensory data obtained from the physio-psychological tests at Harvard University and on current railroad and air-conditioning practices was used to develop a cabin air-conditioning system. It consists of two variable-speed centrifugal superchargers which deliver a total of about 20 cu.ft. of air per person per min. The air passes through a circuit containing a heater, an intercooler, and a turbine to provide heat or refrigeration. A separate system controls the humidity.

A Note on Axial Flow Fans for Aircraft Ventilation. J. A. C. Williams. *Aircraft Engineering*, Vol. 19, No. 218, April, 1947, pp. 130–132, illus. 6 references.

A survey of the aerodynamic principles of axial flow fans, their basic design, performance characteristics, and application for ventilating and for recirculating air in aircraft cabins.

Vibration Standards Proposed. Stanley Lippert. *SAE Journal*, Vol. 55, No. 5, May, 1947, pp. 32–34, diagrs. 10 references. (Abstract of a paper: Human Responses to Vertical Vibration.)

A simple and convenient classification is proposed as a standard by which to measure the gross reaction of passengers to vibrations. It conforms closely to the curves established by other investigators and to test results obtained by the Douglas Aircraft Co., Inc.

Control Systems

Collection and Analysis of Hinge-Moment Data on Control-Surface Tabs. Paul E. Purser and Charles B. Cook. *U.S., N.A.C.A., Technical Note No. 1113*, April, 1947. 31 pp., figs. 27 references.

An analysis of available tab hinge-moment data obtained in two- and three-dimensional force tests and in two-dimensional pressure-distribution tests indicated that the present methods of estimating the rate of change of the flap section hinge-moment coefficient with the angle of attack and with the flap deflection could be extended to certain chord ratios. This extension could be made over small ranges of angle of attack and flap deflection to those chord ratios that are small enough to include the rate of change of the section hinge-moment coefficient with angle of attack.

Estimation of Control Forces of Spring-Tab Ailerons from Wind-Tunnel Data. Owen J. Deters. *U.S., N.A.C.A., Technical Note No. 1333*, June 1947. 24 pp., diagrs. 3 references.

A method of estimating the control forces of geared spring-tab ailerons. The method is applied to interconnected ailerons employing a central spring unit and to ailerons that are not connected, each employing an individual preloaded spring unit. It supplies both the coefficient of the aileron and the hinge-tab moment and the characteristics of the linkage system. The principles of the method can be applied in the estimation of the forces of other controls.

Tail-Design Requirements for Satisfactory Spin Recovery for Personal-Owner-Type Light Airplanes. A. E. Neihouse. *U.S., N.A.C.A., Technical Note No. 1329*, June, 1947. 11 pp., diagrs. 3 references.

The design requirements for airplane tail surfaces that would provide effective control for satisfactory recovery from fully developed spins have been determined from analysis of the characteristics of approximately 60 models previously tested in the Langley spin tunnels. Although these models did not represent actual airplanes, they had proportions of mass and dimensional characteristics representative of many in the personal aircraft category.

Wind-Tunnel Investigation of Shielded Horn Balances and Tabs on a 0.7-Scale Model of XF6F Vertical Tail Surface. John G. Lowry, James A. Maloney, and I. Elizabeth Garner. *U.S., N.A.C.A., Advance Confidential Report No. 4C11 (Wartime Report No. L-516)*, March, 1944. 75 pp., figs. 3 references.

A Flight Investigation of Internally Balanced Sealed Ailerons. W. C. Williams and H. F. Kleckner. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-480)*, December, 1941. 10 pp., figs. 1 reference.

An Additional Investigation of the High-Speed Lateral-Control Characteristics of Spoilers. Edmund V. Laitone and James L. Summers. *U.S., N.A.C.A., Advance Confidential Report No. 5D28 (Wartime Report No. A-21)*, June, 1945. 40 pp., figs. 2 references.

Engine Parts and Accessories

Distribution of Bearing Reactions on a Rotating Shaft Supported on Multiple Journal Bearings. S. S. Manson and W. C. Morgan. *U.S., N.A.C.A., Technical Note No. 1280*, May, 1947. 25 pp., diagrs. 6 references.

An analytic treatment of the problem of determining the distribution of reaction forces among multiple plane bearings supporting a shaft subjected to rotating loads. The treatment differs from others in common use in that account is taken of the hydrodynamic effect of the oil film between the journals and the bearings. A relation is expressed between the eccentric running position of a journal within its bearing and the load hydraulically supported by this bearing. This relation, together with the conditions of elasticity for the shaft and the bearing supports, provides a sufficient number of equations for an analytical determination of the reactions at each bearing of a multiple-bearing system. Results of tests indicated that the hydrodynamic effect should be considered in problems involving the distribution of bearing reactions.

An Improved Method of Measuring Piston Ring Wall Thrust. B. Pugh. *Institution of Mechanical Engineers, Proceedings*, Vol.

155, War Emergency Issue No. 21, pp. 299–302, illus. Discussion, pp. 315–322.

An instrument originally designed for comparing the wall-thrust patterns of new and used rings has also been used to study the effect of variation of ring toe-out and ovality. This work has indicated that there is a definite limit to increasing the toe-out ovality with a view to stiffening the ring at the horns and that beyond this limit increase of toe-out and ovality is accompanied by rapid and progressive breakup of the wall-thrust pattern.

Description of Russian Aircraft Engines "AM 35" and "AM 38." H. Denkmeier and K. Gross. (*Deutsche Luftfahrtforschung, ZWB/UM/690,* August 1, 1942.) *U.S., N.A.C.A., Technical Memorandum No. 1169,* June, 1947. 22 pp., illus.

Only those portions of the original document which describe the Russian-developed swirl throttle have been translated and are presented here. A shutter composed of radial guide vanes is mounted before the air intake. All the vanes are pitched simultaneously by a crown gear that articulates with pinion gears on the vane tips. The pitch change is transmitted by a boost-pressure regulator to one of the vanes. When in an oblique position the vanes impart a spiral motion to the air in the direction of rotation of the supercharger. This reduces the driving power of the supercharger. The reduced work is followed by a smaller temperature rise in the compressor. The swirl throttle operates as a function of the boost-pressure regulator. The oblique setting of the vanes decreases as the altitude increases. Thus, the effect of the throttle on the adiabatic pressure head of the supercharger is greatest near sea level. The work saved by this modification permits very high supercharger speeds at sea level and eliminates gear shifting for low altitudes.

Air-Cleaning Intakes for Aero-Engines. F. J. Bigg. *Aircraft Engineering,* Vol. 19, No. 218, April, 1947, pp. 112–117, figs.

A complete discussion of the problem of aircraft air cleaning. The results of desert tests and laboratory tests are given to determine the best location of the air-intake unit. Ram filters, momentum deflection installations, and units employing both types of cleaners are evaluated with respect to their location on the aircraft and to the type of airplane. The test methods and formulas used in laboratory testing of air-cleaning intakes and filters and graphs of their efficiency are discussed. The problem is extended to jet engines and current solutions are evaluated.

Tests on Model Rotors for Axial Blowers. W. Encke. (*ZWB/UM/3135,* April, 1944.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. EDC 10/5661T.* 25 pp., figs.

A survey of the characteristics of nine compressors and the design dimensions of their blade profiles. The rotors of this series are models used in the development of a five-stage axial-flow, 30,000-r.p.m. supercharger designed for operation at 5,000-m. altitude. Profile and blade tip speed were selected to give a maximum boost between stages and a maximum reduction in size and weight of the compressor.

Lubricant Cooler Investigations Under High Altitude Conditions: Intermediary Report II. Hilpert and Woehler. (*Luftfahrtforschungsanstalt Hermann Göring, ZWB/UM/2087,* April 25, 1944.) *U.S., Army Air Forces, Translation No. F-TS-915-RE,* April, 1947. 75 pp., figs.

Test report on the characteristics of the Fo 866 oil cooler designed by Dr. Schlupp of the Süddeutsche Kühlerfabrik. A diagram of the test setup is given, and the performance at altitudes of 0, 5, 6, 11, and 14 km. is analyzed. The methods of measuring the temperature field behind the cooler is described.

Internally Finned Honeycomb Radiators. Arthur N. Tifford. *U.S., N.A.C.A., Advanced Restricted Report (Wartime Report No. L-492),* December, 1941. 19 pp., figs.

Poppet Valves for Automotive and Aircraft Engines. L. E. Bogue and Norman Hoertz. *U.S., Field Information Agency, Technical Final Report No. 525,* December 13, 1945. 19 pp., illus. British Information Services, New York. $0.70.

Materials and manufacturing methods used by five German manufacturers of poppet valves and notes on an engine provided with a rotating plate for opening and closing the intake and exhaust ports.

Aero Engine Accessories (Bosch and Riedel). D. L. Brown, E. Youel, and R. A. S. Reid. *Combined Intelligence Objectives Sub-Committee, Item Nos. 1, 5, 26, File No. 30–45.* 34 pp., illus. British Information Services, New York, $1.00. Descriptions of ignition equipment, engine starters, fuel pumps, test-stands, and other equipment designed and produced at the German plants named.

Investigations of Cowl Inlets for the B-29 Power-Plant Installation. Louis L. Monroe and Martin J. Saari. *U.S., N.A.C.A., Memorandum Report No. E5 K30 (Wartime Report No. E-205),* January, 1946. 81 pp., illus. 4 references.

Heat-Transfer Tests of a Steel Cylinder Barrel with Aluminum Fins of Optimum Proportions. Herman H. Ellerbock, Jr., and Alvin H. Mann. *U.S., N.A.C.A., Memorandum Report (Wartime Report No. E-204),* November, 1940. 15 pp., illus. 4 references.

Flight Investigation of the Performance and Cooling Characteristics of a Long-Nose High-Inlet Velocity Cowling on the XP-42 Airplane. F. J. Bailey, Jr., J. Ford Johnston, and T. J. Voglewede. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-356),* April, 1942. 36 pp., illus. 2 references.

Engines—General

On the Effectiveness of Various Models of Detonation or Combustion. Charles DePrima and Anneli Leopold. *New York University, Institute of Mathematics and Mechanics, AMG-NYU No. 145,* February, 1946. 51 pp., figs. 10 references.

A theoretical study in which pressure is computed as a function of time to determine whether the effectiveness of a jet engine can be increased by controlling the mode of detonation or combustion.

Luftfahrtforschungsanstalt Hermann Göring, Volkenrode, Brunswick. F. Sebba. *Combined Intelligence Objectives Sub-Committee, Item No. 25, File No. 25-2.* 14 pp. British Information Services, New York. $0.90.

Two of the five institutes comprising the Establishment were investigated, the Engine Research and the Weapon Research projects. Engine research work dealt principally with heat transfer, combustion, detonation, and fuels, but other work was carried on in connection with solid fuels for rockets, ceramic blades for turbines, gas analysis, thermodynamic functions, and fuel nozzles. The Weapons Institute was engaged largely in research on rocket fuels and their components, including such materials as T-Stoff, C-Stoff, initiators, catalysts, cutting agents, vinyl esters, and others, auxiliary fuels for conventional engines and rocket assistants for take-off were also developed there.

Propulsion. J. L. Beilschmidt. *Aeronautics,* Vol. 16, No. 3, April, 1947, pp. 36–43, figs.

All types of propulsion depend on the same basic principle, Newton's third law of motion. The relation between thrust and efficiency determines the performance of the various types of power plants. The characteristics of the propeller, the jet, and the jet turbine are calculated and their limiting factors are compared. The principles are illustrated by simple analogies, and the theory is expressed in simple mathematical relations.

Definition of Rocket Propulsion Terms. George James. *Astro-Jet,* No. 16, March, 1947, pp. 13–16, 20.

Engines, Gas Turbine

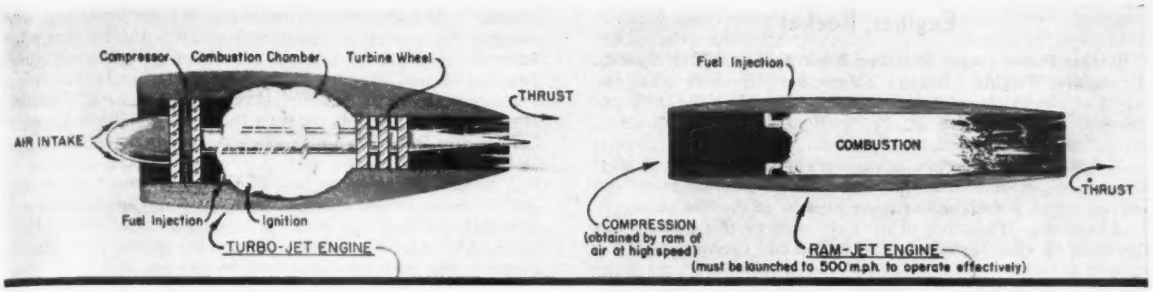
Study of Efficiency and Thrust of Conventional Turbojet Propulsor. B. Szczeniowski. *University of Montreal.* (For abstract see "I.A.S. Briefs" on page 30 of this issue, August, 1947.)

The Application of High-Temperature Strain Gages to the Measurement of Vibratory Stresses in Gas-Turbine Buckets. R. H. Kemp, W. C. Morgan, and S. S. Manson. *U.S., N.A.C.A., Technical Note No. 1174,* April, 1947. 28 pp., illus. 1 reference.

The satisfactory detection and determination of vibratory stresses in gas-turbine buckets was accomplished at operating speeds under temperatures up to 1,500°F. by a high-temperature wire strain gage. The gages were cemented to the buckets and the signals transmitted by lead wires through the hub and axis of the rotor to slip rings. The three balancing arms of the Wheatstone bridge circuit were mounted on the rotating part of the slip-ring assembly to minimize slip-ring effects. The construction and calibration of the gage and the modification of the rotor are detailed.

An Investigation of the Effect of Blade Curvature on Centrifugal-Impeller Performance. Robert J. Anderson, William K. Ritter, and Dean M. Dildine. *U.S., N.A.C.A., Technical Note No. 1313,* May, 1947. 20 pp.; illus. 5 references.

Tests were made to determine the effect of different pressure blade loadings on the efficiency, the pressure ratio, the flow capacity, and the range of centrifugal-type impellers. The scope of the investigation was limited to the type of impeller in which the



The After Burner, developed by the Ryan Aeronautical Company for the Navy, is claimed to boost the thrust of jet engines by as much as one-third.

angular velocity of the air is accelerated to the angular velocity of the impeller before any appreciable compression by centrifugal force is allowed. Impeller A had a parabolic blade curvature and a constant blade loading. Impeller B had an elliptical blade curvature with a loading that decreased with increasing impeller depth. Impeller C had a circular blade curvature with the highest initial blade loading, which also decreased with impeller depth. Impeller B had the highest peak adiabatic efficiency except at tip speeds of 1,400 and 1,600 ft. per sec., at which speeds impeller A had the highest efficiency. Impeller C had the lowest adiabatic efficiency for speeds over 1,000 ft. per sec. All three impellers decreased in adiabatic efficiency with increasing tip speed.

Analysis of Composite-Powered Aircraft. Ben T. Salmon. *Preprint, S.A.E. Summer Meeting*, French Lick, Indiana, June 1–6, 1947. 11 pp., illus.

The turboprop engine combines the speed and climb characteristics of the jet power plant with the low speed, take-off, maneuverability, and range of the propeller-drive power plants. The simplicity of the engine and its lighter weight can make an increased pay load possible. The low-grade fuels, which the composite engine can use, is an economy factor that gives it superiority over other power plants in commercial aviation.

Gas Turbine Propulsion Systems. A. H. Redding. *Aero Digest*, Vol. 54, No. 5, May, 1947, pp. 75–77, 149, illus.

A detailed analysis of the efficiency of propulsion systems. The elements of a turbojet engine are discussed in reference to the overall efficiency of the engine. Ten modifications of the simple turbojet engine are analyzed, and their advantages under various operating conditions are compared. The ducted-propeller turbojet is offered as the best intermediate between the turbojet that is efficient as high speeds and the turboprop that is efficient at low speeds.

Junkers Aircraft and Engine Facilities. C. L. Fay. *Combined Intelligence Objectives Sub-Committee, Item No. 5, 25, 26, File No. 31–36.* 37 pp., illus. British Information Services, New York. $1.15.

History of development and production work at the various Junkers plants, chiefly concerning the company's gas turbines, although production of air frames and reciprocating engines in certain plants is reported.

Investigation of Activities of William Prym, Stolberg and Zweifall, Rheinland. S. T. Robinson. *Combined Intelligence Objectives Sub-Committee, Item No. 5, File No. 6-28, 29, 8–13.* 37 pp., figs. British Information Services, New York. $1.15. Development and manufacture of hollow-turbine blades for the Jumo 004 engine.

Fuel Systems for Jet Aircraft. W. H. Curtis and W. J. Lansing. *SAE Journal*, Vol. 55, No. 6, June, 1947, pp. 50–53, figs. (Extended abstract of a paper: Study of Fuel Systems for Jet Aircraft.) (Cf. AER 3/47:58.)

Essential Requirements of a Gas Turbine Installation. Gaylord W. Newton. *Western Flying*, Vol. 27, No. 5, May, 1947, pp. 20, 21, 36, 38, illus. (*See* AER 6/47:39.)

Power Units for Future Aircraft. F. R. Banks. *Thornton Aero Engine Research Laboratory, Thornton-le-Moors, Cheshire, England, Report No. 36*, April 30, 1946. 44 pp., illus. (Cf. AER 3/47/59.)

Review of Jet Designs—1930 to 1946. Clifford J. Lane. *SAE Journal*, Vol. 55, No. 5, May, 1947, pp. 24–29, illus. (Excerpts from a paper: Design Development of the Gas Turbine.)

Engines, Pulse-Jet

A Gas Dynamical Formulation for Waves and Combustion in Pulse-Jets. J. K. L. MacDonald, S. A. Schaaf, and others. *New York University, Institute for Mathematics and Mechanics, Report No. AMG-NYU* 151, June, 1946. 64 pp., diagrs. 16 references.

A brief outline summarizes the known experimental data on the motions of the gases and flames in pulse-jets. A comprehensive one-dimensionalized hydrothermodynamical formulation which is then developed for pulse-jets includes terms corresponding to (a) wave and flame propagation throughout the jet, (b) effective duration of burning in the turbulent gases, and (c) nonuniform cross section and boundary conditions at the intake and at the exhaust ends. An idealized example is solved explicitly on the basis of presumably reasonable assumptions which represent observed features and contradict some assumptions made in previous theoretical treatments. A variety of alternate forms is presented to provide a framework into which future observations and explicit examples may fit.

Engines, Reciprocating

Air-Cooled Engine Performance: Theoretical Aspects of Analyzing Cooling Test Data. Daryl Davidson. *The Nebraska Blue Print*, Vol. 46, No. 8, May, 1947, pp. 181, 182, 190, illus. 5 references.

An analysis of the basic thermodynamic formulas required to calculate the heat-transfer characteristics of an air-cooled engine. The formulas are presented as an illustration of the type of calculation and theoretical research that precedes the actual engine test program.

Helicopter Engine Cooling. A. Currie. *Aero Digest*, Vol. 54, No. 6, June, 1947, pp. 66, 67, 124, 127, figs.

A theoretical treatment of baffle, compressor, and blade design for an engine pressure-cooling system suitable for buried aircraft power plants.

The "Cyclone" 18-BD. *Aero Digest*, Vol. 54, No. 6, June, 1947, pp. 58–61, 128, illus.

Wright Aeronautical's 18-BD Cyclone, a development of the R-3350, is an 18-cylinder, double-row, air-cooled, radial engine with a two-speed supercharger employing the new inducer-type impeller. It has forged aluminum cylinder heads and forged steel crankcases. It uses direct fuel injection into each cylinder and low-tension ignition. Type certificated at 2,500 hp. It has a performance ceiling of 35,000 ft. The fuel pump, fuel injection master control, cylinder and crankcase, and sump and scavenge pump assemblies are shown in cutaway and exploded drawings.

Rolls-Royce "Eagle" Engine. *Aero Digest*, Vol. 54, No. 6, June, 1947, pp. 68, 124, 127, illus. (Cf. AER 3/47:61.)

The Gipsy Major of To-Day. *De Havilland Gazette*, No. 17, February, 1947, p. 12, illus.

Some performance data on the de Havilland Gipsy Major 10, which has a running speed of 2,300 r.p.m., in contrast to the 2,100 r.p.m. of the Gipsy Major I. Power is thus increased from 130 hp. to 145 hp. with no change of bore and stroke. The Gipsy Major 10 is lighter and can accommodate leaded fuels.

A Cooling-Correlation Equation for a Double-Row Radial Engine Based on the Temperature of the Exhaust-Valve Seat. James M. Jagger and Fred O. Black, Jr. *U.S., N.A.C.A., Memorandum Report No. E5D30a (Wartime Report No. E-201)*, April, 1945. 19 pp., illus. 2 references.

Engines, Rocket

Rocket Power Plants Based on Nitric Acid and Their Specific Propulsive Weights. Helmut Zborowski. (*Deutsche Akademie der Luftfahrtforschung, Schriften, Heft 1071, Nr. 82,* 1943, pp. 91–126.) *U.S., N.A.C.A., Technical Memorandum No. 1145,* May, 1947. 36 pp., illus.

In spite of the theoretical advantages of liquid oxygen as a fuel for rockets, nitric acid better serves the purpose of an oxygen carrier for large-scale military use because of its ease of supply and handling. The scope of the nitric acid type of power plant lies between that of the solid fuel rocket and the turbojet. Examples of this system are described, and specific values are given for their aerodynamic and ballistic characteristics. Recent developments in reducing the ignition time of the nitric oxide-reactant type fuels point toward a greater reduction of the weight per unit thrust, which will result in an increase in the remaining flying time available for higher altitudes.

Rockets Using Liquid Oxygen. Adolf Busemann. (*Deutsche Akademie der Luftfahrtforschung, Schriften, Heft 1071, Nr. 82,* 1943, pp. 127–143.) *U.S., N.A.C.A., Technical Memorandum No. 1144,* April, 1947. 19 pp., figs. 1 reference.

Liquid oxygen as the oxidizer in a rocket propulsion system presents unique problems in design. The reaction in the combustion chamber, the design and function of the nozzle, and the value of using atmospheric oxygen additives are discussed.

H. Walter Kommanditgesellschaft, Kiel (Materials for Bi-Fuel Rockets). R. M. Chapman. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 556, Item No. 4.* 20 pp. British Information Services, New York. $0.70. Measures taken to prevent corrosion or other contamination of metals and other materials in contact with T-Stoff and C-Stoff rocket fuels.

Fire Prevention

Fighting the Engine Fire. *Aero Digest,* Vol. 54, No. 6, June, 1947, p. 50, illus.

A new fire-extinguishing agent, manufactured by Walter Kidde & Co., Inc., known as methyl bromide CB, is a mixture of 82 per cent monochlorobromethane, 9 per cent methylene chloride, and 9 per cent methylene bromide. Another compound, known as methyl bromide DL, contains 65 per cent methyl bromide CB and 35 per cent CO_2. Both compounds extinguished engine fires in slightly less time than CO_2. Only 4 lbs. of either of these mixtures, as compared with 10 lbs. of CO_2, are required.

New Fire Detection Unit. *Aero Digest,* Vol. 54, No. 6, June, 1947, p. 50, illus.

A transmitter that can be calibrated for temperatures above 600°F. closes an alarm circuit when the cartridge case elongates under the influence of heat. The circuit opens automatically when the temperature drops below the critical value for the system. The unit is manufactured by Fenwal, Inc.

Flight Testing and Performance

Effect of 40° Sweepback on the Spin and Recovery Characteristics of a $^1/_{25}$-Scale Model of a Typical Fighter-Type Airplane as Determined by Free-Spinning-Tunnel Tests. Stanley H. Scher. *U.S., N.A.C.A., Technical Note No. 1256,* April, 1947. 27 pp., illus. 3 references.

Spin and recovery characteristics for a range of typical fighter-type loading conditions and for two tail designs. The results of the tests indicated that, for the model with the tail design that was considered unsatisfactory for spin recovery, sweeping the wings back 40° improved the recovery characteristics appreciably. With a revised tail design that was considered satisfactory for spin recovery with the unswept wing, sweeping the wings back 40° had little effect.

Influence of Fuselage, Sweep-Back, and Stabilization on the Flying Range of Turbo-Jet Aircraft. S. Gunter. (June, 1945.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 3/E/14T.* 5 pp., figs.

The range is shown to be determined by the ratio of the Mach Number to the lift-drag coefficient. This ratio in turn is determined by the relation existing between the size of the aircraft, the total surface area, and the profile thickness. A nomogram is given relating the weight of the aircraft, the specific density of the air, and the density of the airplane to its size. Another nomogram

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determines the Mach Number-lift-drag coefficient by the relation between the size, the profile thickness, and the surface area.

The Range of Jet Propelled Aircraft. A. Lippisch. (*Messerschmitt A.G.*, Agsburg, March 15, 1940.) *Cornell Aeronautical Laboratory*, Buffalo, March, 1947. 10 pp., figs.

The relationships among the maximum, minimum, and optimum lift-drag ratios and the range and velocity factor are computed for jet aircraft. According to these calculations and according to the data available in 1940, a jet aircraft should have a range of 3,500 km. at high altitudes.

A Theoretical Investigation of Dynamic Stability with Free Elevators. J. Whatham and H. M. Lyon. *Gt. Brit., Aeronautical Research Committee, Reports and Memoranda No. 1980*, March, 1943. 19 pp., figs. 6 references.

An unstable pitching oscillation similar to directional snaking can occur with a free elevator if it is closely balanced aerodynamically and has no mass-balance or if an inertia weight is added in the circuit. In the critical region close to the stability boundary a small increase in weight moment, or a decrease in the negative ratio between the rate of change of the coefficient of the moment about the elevator hinge and the rate of change of the increment in the elevator angle during disturbed flight, may change a well-damped oscillation into a rapidly growing one. On the stable side of this critical region elevator moment of inertia and damping have little effect on the motion and can be neglected in investigations of maneuverability.

Notes on Maximum Airplane Angular Velocities. H. M. Conway. *U.S., N.A.C.A., Confidential Bulletin No. 3E19 (Wartime Report No. W-101)*, May, 1943. 16 pp., tables. 12 references.

Some Notes on the Effects of Jet-Exit Design on Static Longitudinal Stability. Clarence L. Gillis and Joseph Weil. *U.S., N.A.C.A., Memorandum Report No. L6D30a (Wartime Report No. L-589)*, May, 1946. 30 pp., diagrs. 5 references.

Wind-Tunnel Investigation of the Effect of Jet-Motor Operation on Stability. Wallace F. Davis and Sherwood H. Brown. *U.S., N.A.C.A., Memorandum Report (Wartime Report No. A-31)*, July, 1944. 24 pp., figs. 3 references.

Tests of an Attack-Type Airplane in the Ames 40- by 80-Foot Wind Tunnel to Improve the High-Speed Maneuvering Control-Force Characteristics. Gerald M. McCormack. *U.S., N.A.C.A., Memorandum Report A5K16 (Wartime Report No. A-2)*, November, 1945. 89 pp., charts. 5 references.

A Comparison of Two Flight-Test Procedures for the Determination of Aileron Control Capabilities of an Airplane. Richard B. Skoog. *U.S., N.A.C.A., Advance Restricted Report No. 5E22 (Wartime Report No. A-37)*, July, 1945. 19 pp., figs.

Calculated and Measured Turning Performance of a Navy F2A-3 Airplane as Affected by the Use of Flaps. Lawrence A. Clousing, Burnett L. Gadeberg, and William M. Kauffman. *U.S., N.A.C.A., Advance Confidential Report No. 3130 (Wartime Report No. W-6)*, September, 1943. 58 pp., figs. 5 references.

Full-Scale Wind-Tunnel and Flight Tests of a Fairchild XR2K-1 Airplane with a Zap Flap and Upper-Surface Aileron-Wing Installation. L. A. Clousing, Robert R. Lehr, and William J. O'Sullivan. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report Report No. L-437)*, March, 1942. 42 pp., figs. 11 references.

Comparison of the Energy Method with the Accelerometer Method of Computing Drag Coefficients from Flight Data. Thomas L. Keller and Robert F. Keuper. *U.S., N.A.C.A., Confidential Bulletin No. 5H31 (Wartime Report No. A-57)*, October, 1945. 18 pp., figs. 2 references.

Fuels

Fuels for Rocket and Jet Power Plants. E. L. Klein. *Preprint, S.A.E. Summer Meeting*, French Lick, Indiana, June 1–6, 1947. 16 pp., illus.

The mixed acid-monoethylaniline and the liquid oxygen-ethyl alcohol type systems are the only liquid fuel systems available for operational use in this country. At present the specific impulse obtainable from a chemical reaction is limited by the combustion chamber temperature and the molecular weight of the exhaust gases to a value of approximately 250 sec. for a service-type engine. To be practicable a propellant must be safe to store and handle, must provide a maximum specific impulse with a minimum volume per unit weight, and must be readily available and inexpensive. Combustion efficiency is generally believed to be primarily a matter of mechanical design of the combustor. The choice of fuel will probably be determined by its availability. However, work is still required to determine the effects of the various fuel variables on combustion and engine operation and to correlate the results of small-scale combustor and full-scale engine fuel tests.

Fuels and Lubricants for Aero Gas Turbines. I. C. G. Williams. *Shell Aviation News* (London), No. 106, April, 1947, pp. 14–20, diagrs.

While efficiency of design may make it possible to develop a gas turbine that will be able to accommodate any kind of liquid fuel, good low-temperature characteristics, combustion efficiency, flame blowout, and carbon deposition are the factors that determine the best fuel. The results of past practice and current research on these topics are described in detail.

Preparation and Physical Properties of Several Alphatic Hydrocarbons and Intermediates. Frank L. Howard, Thomas W. Mears, and others. *U.S., Bureau of Standards, Journal of Research*, Vol. 38, No. 3, March, 1947, pp. 365–395, figs. 43 references. Available also as Research Paper RP1779 (Govt. Printing Office, Washington, $0.15), and as U.S., N.A.C.A., Technical Note No. 1247.

A description of the methods of preparation and purification of three pentanes, four hexanes, three heptanes, five octenes, six nonenes, six decenes, and a number of alcohols, ketones, esters, and alkyl halides. Most of these compounds were highly purified. Physical constants measured included freezing point, boiling point and its variation with pressure, refractive index, and density and their variations with temperature.

Notes on the Initial Operation and Test Run of a 100 Octane Aviation Gasoline Plant. Utah Tsao. *Chinese Institute of Engineers, Journal*, Vol. 5, No. 1, May, 1947, pp. 31–49, illus.

A plant was built in Houston, Tex., by the Lummus Company for a government agency. It had a capacity of 5,300 barrels per day and employed a catalytic cracking unit of the moving-bed type which comprised two duplicate units using a natural clay catalyst. The construction engineering problems and the operating problems met during the 15-day continuous test run are discussed. Test run yield data are tabulated. Laboratory inspection sheets for the 15-day test run are reproduced.

Aircraft Fuels and Lubricants Research at Thornton-Le-Moors. *Engineering*, Vol. 163, No. 4240, May 2, 1947, pp. 355–357, 360, illus.

During the war this organization conducted work on fuel mixtures and fuel development which resulted in marked increase in aircraft performance. Research on the maldistribution of lead tetraethyl and lead bromide in the cylinders lead to the development of the "Thornton straightener," which greatly increased spark plug efficiency. A program of investigation of captured German engines and fuels led to further investigation of the direct injection method. One section of the establishment is devoted to the study of the problems of fuel combustion and the reaction engine. The article is comprehensive and describes not only the work of the laboratory and its basic equipment but many of the instruments and techniques they have developed.

Thornton Aero-Engine Research Laboratory. *The Engineer*, Vol. 183, No. 4761, April 25, 1947, pp. 360–362, illus. (Cf. preceding abstract.)

Wirtschaftliche Forschungsgesellschaft m.b.H., Stockdorf near Munich. L. L. Newman and H. M. Weir. *Combined Intelligence Objectives Sub-Committee, Item No. 30, File No. 25-4*, June 18, 1945. 5 pp., British Information Services, New York. $0.20.

A survey of an underground system of gasoline storage. The advantages of uniform temperatures and consequent reduction in evaporation losses frequently may be offset by losses due to undetected underground pipe-line leaks.

Gliding and Soaring

Sporting Glider Pick-Up. Walter Setz. *Soaring*, Vol. 11, No. 3-4, March-April, 1947, pp. 10–12, illus.

A comparison of the cost of installation and operation of three types of glider pickups manufactured by All American Aviation, Inc.: two reel assemblies, models 4C and 15; and Unolyn, an energy absorbing plastic rope.

Tips on Flying a Sailplane on Instruments. Stan Hall. (Republished from *The Thermal*, March, 1947.) *Soaring*, Vol. 11, No. 3-4, March-April, 1947, pp. 13, 14.

A glider that is to be flown on instruments should not require noticeable control pressures to maintain steady cruising flight. The pilot should be thoroughly familiar with his instruments and their idiosyncracies in the actual presentation of flight data. He should also know his own reactions and be able to compensate for sensory illusions.

The Wanderlust. T. E. Brown. *Soaring*, Vol. 11, No. 3-4, March-April, 1947, pp. 4, 5, illus. (Cf. AER 7/47:49.)

Guided Missiles

Flight Control of Rockets. Gifford White. *Aero Digest*, Vol. 54, No. 5, May, 1947, pp. 50, 51, 142, 143, illus. (Cf. AER 4/47:53.)

The German V-2 contains an internal control system that is independent of radio, radar or any external guiding device. This system sets the path of flight in such a way that at a predetermined point in space the missile will have the correct azimuth, elevation, pitch, and velocity to proceed on a trajectory toward the target. At the beginning of the take-off, while the velocity is too low for the fins to stabilize the flight, carbon vanes in the jet exhaust provide the control. Both these vanes and the fins are deflected as required by servomotors which are controlled by a gyroscope. The change in pitch which is needed is accomplished by a predetermined rotation of the gyroscope index. When the velocity has reached the required peak, the fuel supply is automatically cut off. During the remainder of the flight the control system compensates for deviations from the preselected trajectory.

Hydraulic Equipment

Hydraulic Swivel Design. Bernard J. McCabe. *Aero Digest*, Vol. 54, No. 5, May, 1947, pp. 88, 91, 140, diagrs.

The difficulties presented by flexible lines in accommodating hydraulic fluid to moving parts can be eliminated by the use of rigid lines connected by swivel couplings. This method can only be used when the fixture is placed at the center of rotation of the moving member. Even though it is a specially machined part, it effects a great weightsaving and economy of space. Its toroid bearing may have only a tolerance of ±0.003. An example is given for dimensioning a typical fitting.

O-Ring Seals. David R. Pearl. *Machine Design*, Vol. 19, No. 5, May, 1947, pp. 97–102, diagrs. (Cf. AER 3/47:66.)

Ice Prevention

Thermal Fin Effect in Heat Anti-Icing Corrugations. Julius Jonas. *Northrop Aircraft, Inc.* (For abstract see "I.A.S. Briefs" on page 31 of this issue, August, 1947.)

Report on the Suitability of Transparent Metal Layers for the Electric Surface Heating of Windshields. Bethge. (*ZWB/AVAG/40/7/9*, August, 1940.) *U.S., Army Air Forces, Translation No. F-TS-1523-RE*, May, 1947. 22 pp., illus. 12 references.

Patent application (Z. 24526) by Hans Ruehle of the Zeiss Ikon A.G. proposes the heating of windshields by depositing a transparent metallic film over the entire surface and using the film as a resistor heating element. Production samples using gold and silver had a film thickness of 20μ which gave a 35 per cent light permeability. Permeability and resistance characteristics of thin metal films under current methods of deposition indicate that the range of the film thickness must be kept between 5 and 40μ. In this range the permeability decreases from 77 to 10 per cent, and the resistance decreases from 125 to 1 ohm. Mechanical characteristics eliminate the more acceptable metals, and it appears that for practical purposes optical permeability and electrical conductivity are mutually exclusive.

A Flight Investigation of the Thermal Properties of an Exhaust Heated Wing De-Icing System on a Lockheed 12-A Airplane. Lewis A. Rodert and Lawrence A. Clousing. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. A-45)*, June, 1941. 27 pp., illus. 10 references.

Preliminary Report on Flight Tests of an Airplane Having Exhaust-Heated Wings. Lewis A. Rodert, William H. McAvoy, and Lawrence A. Clousing. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. A-53)*, April, 1941. 24 pp., illus. 4 references.

An Investigation of the Characteristics of a Propeller Alcohol Feed Ring. Carr B. Neel, Jr. *U.S., N.A.C.A., Restricted Bulletin No. 4F06 (Wartime Report No. A-50)*, June, 1944. 11 pp., illus.

Tests of Thermal-Electric De-Icing Equipment for Propellers. Richard Scherrer and Lewis A. Rodert. *U.S., N.A.C.A., Advance Restricted Report No. 4A20 (Wartime Report No. A-47)*, January, 1944. 20 pp., illus.

The Grumman F7F-3N Tigercat, which incorporates a new-type radar housing on the nose to give better streamlining.

Instruments—General

Development of a Photoelectric Manometer. W. Kerris and Weidemann. (*ZWB/FB/1145*, December, 1939.) *U.S., Army Air Forces, Translation No. F-TS-1505-RE*, May, 1947. 9 pp., illus.

The design of a small, light-weight manometer insensitive to acceleration. Pressure variations deflect a mirror that reflects a beam of light to a photoelectric cell. Variations in the intensity of light which correspond to pressure changes are transmitted electrically and recorded on an oscillograph. Specifications given are suitable for pressures up to plus or minus 200-mm. water column.

Instruments, Engine

New Instrument Measures Piston Temperatures. A. C. Sholp, G. R. Furman, and P. A. Binda. *SAE Journal*, Vol. 55, No. 5, May, 1947, pp. 37–39, illus. (Extended abstract of a paper: Instrument for Piston Temperature Measurement.) (Cf. AER 3/47:67.)

Piston temperatures of high-speed engines can be determined accurately with the aid of a contactor that transmits to a galvanometer the voltage generated in a thermocouple installed in the piston. This device replaces the mechanical linkage used to compensate for the reciprocating motion of the engines during piston temperature tests. The contactor unit is installed in the crankcase, and the shoe holder is attached to the piston so that contact between plunger tips and shoes is made only for that portion of the stroke when the piston is near bottom dead center.

Instruments, Flight

A Sonic Altimeter for Aircraft. K. M. Trent. *Combined Intelligence Objectives Sub-Committee, Item No. 1, File No. 32-76.* 12 pp., figs. British Information Services, New York. $0.55. Details of an accoustic altimeter developed by Atlas-Werke which indicates heights above the ground by measuring the time required for a sound pulse to travel from the aircraft to the ground and back again.

A Flight Investigation of Fuselage Static-Pressure-Vent Air-Speed Installations. Richard Sherrer and Lewis A. Rodert. *U.S., N.A.C.A., Advance Restricted Report No. 3K16* (*Wartime Report No. A-64*), November, 1943. 17 pp., illus.

Insurance, Safety, and Rescue

Statistics Make Sense. Rena Josie. *Tennessee Air Progress*, Vol. 2, No. 1, Spring, 1947, pp. 11–13, 24, 25. Analysis of accident statistics for 1944 and 1945 show that the majority of all accidents was caused by errors on the part of the personnel operating or using the aircraft.

AAF Crash Rescue Equipment. *Aero Digest*, Vol. 54, No. 6, June, 1947, pp. 38, 39, illus.

The "forcible entry" kit developed at the Wright Field equipment laboratory contains power-driven saws, a grappling hook, fiber glass fire-resistant protective clothing, carbon-dioxide fire extinguishers, and two walkie-talkie units. Mounted on a jeep equipped with 3-kw. generator, this unit is operated alone or with heavier fire-fighting equipment.

Landing Gear

Taxiing Behavior of Model Aircraft with Nose or Tail Wheel. Dietze and Harling. (*ZWB/FB/1587*, February, 1942.) *U.S., Army Air Forces, Translation No. F-TS-927-RE*, May, 1947. 47 pp., illus. 11 references.

Results of tests with a model landing gear, scale 1:12.3, designed to represent that of a medium-sized aircraft. Optional tail or nose wheel, adjustable friction damping of the swivel axle, and independent braking of the main wheels permitted reproduction of the flexibility of an actual airplane. Wires supplied force comparable to cross wind, and level and banked tracks simulated actual landing conditions. Under all conditions tested the nose wheel displayed greater stability than the tail-wheel landing gear.

Shimmying Tests on Dual Wheels. I—Model Tests. E. Maier and M. Renz. (*Stuttgart, Technische Hochschule, ZWB/FB/1728*, January, 1943.) *U.S., Army Air Forces, Translation No. F-TS-1503-RE*, May, 1947. 23 pp., illus. 2 references.

In connection with the design of tricycle landing gear, the tendency of dual wheels to shimmy, either moving freely on a fixed axle or fixed to a rotating shaft, was investigated and compared with that of a single wheel. Shimmy conditions did not improve with the freely moving wheel. Considerably smaller shimmy ranges at small wheel spacings were observed with the fixed dual wheel.

Static Tests on Annular Spring Legs (Bursting Test). (Gotha Test Report No. 041, Fuselage Fittings.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 13/23T.* 6 pp., figs. Load characteristics of spring shock absorber landing gear Ft 2836 A-1 manufactured by Komprinz A. G., Solingen.

Airborne Aircraft Arresting Gear. A. B. Schultz. *SAE Journal*, Vol. 55, No. 5, May, 1947, pp. 35, 36, diagrs. (Abstract of a paper.)

A spike-topped rocket is fired from the airplane during landing approach. The spike imbeds itself in the earth and acts as a ground anchor. The spike is attached to the airplane with a line made of Unolyn, a ductile plastic material capable of absorbing 50,000 ft.lbs. of stretch for each pound of the material. This device acts as a brake to retard the forward motion of the airplane.

Unveil Plane Wheel Service Stresses with Laboratory Stress-coat Analysis. Marvin H. Polzin. *SAE Journal*, Vol. 55, No. 6, June, 1947, pp. 26–28, 32, illus. (Extended abstract of a paper: The Experimental Determination of Strains in Aircraft Landing Wheels and Brakes.) (Cf. AER 5/47:47.)

Martin Develops Bicycle Landing Gear. *Western Flying*, Vol. 27, No. 5, May, 1947, p. 48, illus.

The problem of retraction of landing gear into the thin wings of jet aircraft led The Glenn L. Martin Co. to place the main landing wheels in tandem fore and aft of the bomb bays in the fuselage. Two outrigger wheels prevent the airplane from listing when not in motion.

Goodyear Cross-Wind Landing Wheel. *Aero Digest*, Vol. 54, No. 5, May, 1947, p. 67, illus. (Cf. AER 6/47:47.)

Detailed description and cutaway drawing of the Goodyear caster-type landing gear. The pivot of this assembly is obtained by a kingpin set at 30° to the ground in such a manner that its point of intersection with the ground is ahead of the point of contact of the tire. It permits a 25° yaw to either side in landing.

New Cross-Wind Gear Successfully Demonstrated. *Western Flying*, Vol. 27, No. 5, May, 1947, p. 30, illus. (Cf. preceding abstract.)

Aluminum Aircraft Skis. *Modern Metals*, Vol. 3, No. 4, May, 1947, pp. 20, 21, illus.

Outline of the development of aircraft skis by Federal Aircraft Works since 1925. Original models were made of metal and wood. This type of construction has been supplanted by aluminum, which has been found to be the most practical and economical material.

Lubrication and Lubricants

An Analysis of the Lubrication Between the Piston Rings and Cylinder Wall of a Running Engine. J. S. Courtney-Pratt and G. K. Tudor. *Institution of Mechanical Engineers, Proceedings*, Vol. 155, War Emergency Issue No. 21, 1946, pp. 293–299, illus. Discussion, pp. 315–322. 9 references.

One of the compression rings was electrically insulated from the piston and a current passed from this ring to the cylinder wall. The potential drop between the moving surfaces was calibrated in terms of the resistance to the current flow. With good conditions of lubrication, the electrical resistance is high, while low resistance values indicate breakdown of the lubricant film and consequent abrasive wear of the surfaces.

Some Notes on the Mechanical Factors Affecting Ring Gumming in Petrol Engines with Particular Reference to the Rating of Lubrication Oils. B. Pugh. *Institution of Mechanical Engineers, Proceedings*, Vol. 155, War Emergency Issue No. 21, 1946, pp. 303–306, diagrs. Discussion, pp. 315–322.

Piston-ring gumming is of primary importance because it has formed the chief criterion in the majority of attempts to rate oils according to their deterioration characteristics. At present it is the only reliable criterion and must be obtained from actual test runs in engines. An attempt is made here to outline some of the mechanical factors involved which are likely to vary from test to

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test, in order to assist in the visualization of the process of piston-ring gumming.

Experiments on the Reproducibility of Engine Conditions for Ring-Sticking Tests in a Single-Cylinder Petrol Engine. G. S. Cantle. *Institution of Mechanical Engineers, Proceedings*, Vol. 155, War Emergency Issue No. 21, 1946, pp. 323–329, diagrs. Discussion, pp. 330–332.

A method has been developed by which the oil consumption rate in small-scale accelerated engine tests can be standardized when other easily controlled factors are maintained constant. The rings are run in with a base oil to which has been added approximately 1 per cent of tributyl phosphite. The rubbing surfaces are bedded for 6 hours. The oil consumption rate is accurately measured throughout the run-in period, and the test is stopped when a standard oil consumption is reached. The engine is dismantled, cleaned with trichlorethylene, and reassembled for running with the test oil. Under these conditions, oil consumption rate curves have been found to give an indication of the manner in which the rings are operating, whether there is incipient ring-sticking, and the time at which the ring sticks completely in its groove.

Tests with the Oil Testing Machine Developed at the DVL. H. Schoekel. (*ZWB/UM/485*, November, 1937.) *U.S., Army Air Forces, Translation No. F-TS-937-RE*, May, 1947. 13 pp., figs.

A vertical shaft is suspended so as to rotate in a bushing, thus forming a test bearing. The load is supplied by a calibrated spiral spring that transfers its force directly to the bearing by means of a pressure pin. When the shaft is rotated, the oil that is being tested is ejected and taken back by the test bearing, forming a continuous lubrication cycle. Oils differing greatly in viscosity were tested and the test results were found to be not repeatable. Inaccuracy in the determination of the friction factor was found.

Maintenance

An Instrument Test Box. *Aircraft Engineering*, Vol. 19, No. 218, April, 1947, pp. 135, 136, illus.

A trouble-shooting test kit. It contains sufficient equipment to make adequate check of the instrument indication for all of the electric, hydraulic, fuel, and lubricant systems. Sufficient adaptors, lines, and leads are supplied to accommodate most fittings. This kit is not intended for instrument repair or calibration but for rapid spot-checking.

Hangar Hints. Oliver R. Luerssen. *Aero Digest*, Vol. 54, No. 6, June, 1947, pp. 40, 41, 111.

A comprehensive check list for trouble shooting. The items are listed by systems, ignition, cooling, fuel and by performance, failure to start, and rough running.

Materials—General

Ceramic Coatings for High-Temperature Protection of Steel. William N. Harrison, Dwight G. Moore, and Joseph C. Richmond. *U.S., National Bureau of Standards, Journal of Research*, Vol. 38, No. 3, March, 1947, pp. 293–307, illus. Available also as Research Paper RP1773 (Govt. Printing Office, Washington, $0.10).

A ceramic coating for the protection of mild steels in high-temperature service was developed at the National Bureau of Standards. It was used during the war on the exhaust systems of aircraft and other vehicles. Laboratory and service tests show these coatings to be superior to conventional porcelain enamels. Their outstanding features are: high resistance to chipping under severe repeated thermal shock; protection of the metal against oxidation during prolonged exposure to air at temperatures up to about 1,250°F.; freedom from cracking and blistering at high temperatures and severe thermal gradients; and a mat surface that does not show highlights. The coatings are prepared from a mixture of a special grade of calcined aluminum oxide and a ground coat frit. On low carbon steel the application may be as thin as 0.002 to 0.003 in.

Some Aspects of German Work on High Temperature Materials. R. Skorski. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 272, Item No. 21.* 11 pp., figs. British Information Services, New York. $0.35. Report of interrogation of German scientists concerning the wartime development of high-temperature metals and ceramic coverings for gas-turbine blades.

Focke-Wulf Structural Research Station (Chemistry and Materials Sections). G. A. Earwicker. *Combined Intelligence Objectives Sub-Committee, Item No. 25, File No. 24-1.* 7 pp., illus. British Information Services, New York. $0.35.

An examination of the type of work done at the Detmold station revealed that it was confined to routine testing and developments. Information was obtained about the testing of materials for pressure cabins, plastics, and exhaust contamination of aircraft.

The Behavior of Rubber at Low Temperatures. W. Kuch and G. Telschow. (*ZWB Research Report No. 1367.*) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 10/1221/T.* 35 pp., figs. 8 references.

Buna S synthetic rubber has better low-temperature characteristics than natural rubber. It has a permanent set point below −70°C. and retained 80 per cent of its plasticity between −46° and −66°C. This Buna S series showed at temperatures as high as 120°C. characteristics equal to those of natural rubber. Resistance of these materials to swelling when in contact with glycol, gasoline, lubricating oil, and brake fluid was found to be equal to that of the rubbers that were not cold-resistant.

Materials—Metals and Alloys

18-8 Steel in Exhaust Systems. Wilson G. Hubbell. *Aero Digest*, Vol. 54, No. 5, May, 1947, pp. 92, 95, 145, 146, illus.

Investigation by the metallurgical section of the Ryan Aeronautical Co. on the effect of precipitated carbides on the corrosion resistance of 18-8 stainless steels led to the consideration of the carbon pickup of this material in the exhaust systems of aircraft. Although this pickup was found to occur, a carbide network that formed was not accompanied by intergranular corrosion. Failure of exhaust systems was found to be caused by excessive heating. Tests are also described which led to the adoption of a formula for a stainless steel that can be welded by the arc, gas, or resistance methods and which can be formed with ease.

The Tensile Properties of Mg-Al and Mg-Al-Zn Sand Casting Alloys. G. Siebel. (*I. G. Farbenindustrie, Versuchsbericht Nr. 2*, 1943.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/12T.* 7 pp., figs.

An investigation of the effect of variation in the aluminum content, increase in the aluminum and zinc content, and the addition of silicon on the mechanical properties and the microporosity of sand castings of Mg-Al and Mg-Al-Zn alloys.

An Investigation of the High Temperature Properties of Chromium-Base Alloys at 1350°F. J. W. Freeman, E. E. Reynolds, and A. E. White. *U.S., N.A.C.A., Technical Note No. 1314*, May, 1947. 21 pp., illus. 3 references.

At the present time the alloy most promising for service at 1350°F. appears to be a 60Cr-25Fe-15Mo alloy with less than 0.05 per cent carbon and 0.5 to 0.7 per cent silicon. This alloy has the best combination of strength at 1,350°F. and engineering properties at room temperature. With care it can be machined and processed in the chill-cast condition in the normal manner.

The Strength at Elevated Temperature of AZ91 Chill Casting Having Small Contents of Copper. H. Vosskühler. (*I. G. Farbenindustrie, Versuchsbericht Nr. 9*, 1940.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/5T.* 5 pp., figs.

Tests at room temperature showed that the strength of this alloy decreased sharply with increasing copper content. This difference decreased progressively with increase in temperature. At 200°C. the curves begin to merge. The difference in elongation increases with rising temperature.

The Effect of Heat-Treatment on the Fatigue Strength of Engine Bearers in AZ855 W (3515.0). W. Buchmann. (*I. G. Farbenindustrie, Versuchsbericht Nr. 40*, 1944.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/21T.* 4 pp., fig.

Tests showed that equilibrium treatment made no difference in the fatigue strength of the billets. Precipitation heat-treatment likewise had no effect on the fatigue strength but slightly increased the hardness.

Analysis of Light Alloys Based on Electrical Resistivity. L. Rotherham and J. I. Morley. *Engineering*, Vol. 163, No. 4242, May 16, 1947, pp. 416–418, illus.

A detailed description of a method of analysis which gives for the richer alloys an accuracy of ±0.30 per cent. This is a rapid method to be used for sampling castings and is more accurate than the spectrographic method.

Some High Percentage Magnesium Alloys. G. Siebel. (*I. G. Farbenindustrie, Versuchsbericht Nr. 5*, 1940.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/4T.* 9 pp., figs.

The Solubility of Bismuth in Magnesium. H. Vosskühler. (*I. G. Farbenindustrie, Versuchsbericht Nr. 61*, 1943.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/14T.* 11 pp., figs.

Thermal Expansion of Co-Fe-Cr Series Alloys and New Alloy "Stainless-Invar." Hakaru Masumoto. (*Jap/MAS/38/5*, April, 1938.) *U.S., Army Air Forces, Translation No. F-TS-706-RE*, April, 1947. 14 pp., diagrs. 7 references.

Plane Designer's Guide to 75ST Aluminum Uses. George Snyder and Frank J. Crossland. *SAE Journal*, Vol. 55, No. 6, June, 1947, pp. 59–62, figs. (Extended abstract of a paper: Use of 75ST in Structural Applications.) (Cf. AER 5/47:49.)

High Temperature Characteristics of 17 Alloys at 1200° and 1350°F. J. W. Freeman, F. B. Rote, and A. E. White. *U.S., N.A.C.A., Advance Confidential Report No. 4C22 (Wartime Report No. W-93)*, March, 1944. 106 pp., illus. 4 references.

Micrographic Examination of Engine Crankshafts. Woge. (*Junkers Test Report No. 46/866*, August 8, 1942.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 17/287T.* 10 pp., illus.

The Influence of Additions of Superoxide to Elrasal on the Mechanical Properties of A9V. G. Schichtel. (*I. G. Farbenindustrie, Versuchsbericht Nr. 56*, 1944.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/22T.* 6 pp., figs.

Influence of Temperature on the Shearing Strength of Stud Bolt Threads in Elektron Casting Alloy A9V and AZG 1. W. Buchmann. (*I. G. Farbenindustrie, Versuchsbericht Nr. 110*, 1943.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/19T.* 4 pp., fig.

Homogenization of Elektron Casting Alloy A9V. G. Schichtel. (*I. G. Farbenindustrie, Versuchsbericht Nr. 71*, 1944.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/23T.* 8 pp., figs.

A summary of tests on cast Elektron alloy A9V to determine the effect of solution heat-treatments at various temperatures and of different duration upon its mechanical properties.

The Influence of Homogenisation on the Mechanical Properties, Structure, and Rate of Extrusion of Alloys AZ 855-W (3515.0) and AZ 855-WZ (3515.9). W. Rosenkranz. (*I. G. Farbenindustrie, Versuchsbericht Nr. 102*, 1943.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/18T.* 14 pp., diagrs.

The Effect of Silicon on the Mechanical Properties of Cast Elektron. G. Siebel. (*I. G. Farbenindustrie, Versuchsbericht Nr. 3*, 1943.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/13T.* 27 pp., figs.

Elfinal Treatment and Chlorination of Elektron: Influence of the Waiting Period on the Mechanical Properties. G. Schichtel. (*I. G. Farbenindustrie, Versuchsbericht Nr. 79*, 1944.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/24T.* 5 pp., figs.

Autoclave Treatment of Elektron in Alkaline Solutions. E. Nachtigall. (*I. G. Farbenindustrie, Versuchsbericht Nr. 62*, 1943.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/15T.* 6 pp., tables.

On Some Experiments Relating to the Problem of the Grain Refinement of Cast Elektron. G. Siebel. (*I. G. Farbenindustrie, Versuchsbericht Nr. 101*, 1944.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/26T.* 28 pp., illus.

Some Investigations on the Grain Refinement of Elektron with Chlorine, Ferric Chloride, and Hydrogen. G. Schichtel. (*I. G. Farbenindustrie, Versuchsbericht Nr. 81*, 1944.) *Gt. Brit., RTP/TIB Translation No. GDC 9/25T.* 7 pp., figs.

The mechanical properties of Elektron alloys containing aluminum can be improved by chlorinating the melts or by introducing various substances such as ferric chloride, iron alloys, or organic compounds.

The new Boeing B-50 superbomber, while similar in external appearance to the B-29, is actually 75 per cent a new airplane. Plane is powered by four 3,500-hp. Pratt & Whitney Wasp Major engines and Curtiss electric propellers and embodies a hinged vertical tail that folds horizontally onto the right stabilizer. The four nacelles are interchangeable, and each contains a single General Electric turbosupercharger, intercooler, and other engine accessories.

Materials—Plastics and Plywood

Report on Plastics and Wooden Parts in German Aircraft. James T. Grey. *Combined Intelligence Objectives Sub-Committee, Item No. 4, 5, 25, File No. 31–8.* 14 pp., illus. British Information Services, New York. $0.55.

New developments in aircraft parts of wood and plastics, including a complete wooden wing for the He 162, a plastic deicing boot, and a sealer or lacquer called Polystal, used for sealing integral fuel tanks in airplane wings.

Compression and Shear Tests on Plywood Skins. *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 13/9T.* 7 pp., figs.

Polyurethanes. Otto Bayer. (*U.S., Department of Commerce, Office of Technical Services, PB 12635.*) *Modern Plastics*, Vol. 24, No. 10, June, 1947, pp. 149–152, 250, 252, 254, 256, 258, 260, 262.

A discussion of the production of this family of plastics. One member, a plastic foam, is proposed as an aircraft material to supplant balsa wood and urea foams for unsinkable airplane parts and for structural uses.

Polyvinyl Acetate in Powder Metallurgy. Harry L. Strauss, Jr. *Modern Plastics*, Vol. 24, No. 10, June, 1947, pp. 196, 198.

Materials—Protective Coating

Corrosion of Metals: Metals in Aircraft Engine Cooling Systems. P. F. Thompson. *Australia, Council for Aeronautics, Report No. ACA-24*, May, 1947. 54 pp., illus.

Following a general account of the theory of corrosion, including the functions of the active corroding agents (oxygen, hydrogen ions, and copper ions), the properties, use, and abuse of inhibitors are examined. An electrochemical technique must be applied in the solution of corrosion problems and in the determination of the controlling factors of corrosion processes, particularly those of iron, copper, and aluminum. The growth and breakdown of films on metals is traced electrochemically and is charted in relation to temperature changes and the consequent aeration and deaeration. The relationship of two types of corrosion to film formation on aluminum is worked out theoretically. Discovery of hydrogen evolution on aluminum during the abrasion in neutral liquids containing water confirms this relationship. The use of a powder in studying abrasions of films on metal in electrolytes is explained. Types of film on aluminum are postulated from electrochemical and abrasion experiments. A corrosion chart for aluminum showing the above relations is reproduced.

Experiments in the Treatment of Elektron for Purposes of Corrosion Protection. III. (*I. G. Farbenindustrie, Versuchsbericht Nr. 75*, 1943.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/16T.* 6 pp., figs.

Comparison of the Corrosion Resistance of Elomag and Flussal Layers on Various Elektron Alloys. E. Nachtigall. (*I. G. Farbenindustrie, Versuchsbericht Nr. 3*, 1942.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC 9/9T.* 9 pp., figs.

Medicine

Respiratory Systems for Airmen. J. G. McDonald. *Aeronautics*, Vol. 16, No. 3, April, 1947, pp. 50–53, figs.

At altitudes above 10,000 ft. the atmosphere does not provide enough oxygen to sustain normal respiration. This difficulty has been overcome in high-altitude aircraft by providing respirators. These, essentially, consist only of a container of oxygen, a gage to measure the contents of the container, a valve to control the rate of flow, and a mask. However, in practice, the system contains, in addition to these elements, a regulator to maintain the oxygen delivered at a constant pressure, a pressure gage calibrated in altitude, and an economizer that cuts off the oxygen supply during expiration.

Navigation

Report on German Kurskoppler, Model 3040-B, Model 3040-G. *Combined Intelligence Objectives Sub-Committee, Final Report No. 21*, September 15, 1945. 12 pp., illus. British Information Services, New York. $0.55.

Description of an automatic dead-reckoning computer for use on aircraft, small boats, and submarines. It is an electromechanical device similar to the American Odograph and the British GPI but is much more compact.

Parachutes

German Parachute Design and Manufacture. N. Shuttleworth, T. E. Pitkethly, and others. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 466, Item No. 27.* 32 pp., figs. British Information Services, New York. $1.00.

A concise account of parachute research, development, and manufacture. Types of parachute include the Schrade braking system and reefing-line device, ribbon types, mushroom types, the triangular design, a porous unit called the Faden-Schirm, and paper parachutes.

Pneumatic Equipment

Pneumatic Units for Aircraft. Willis L. Nye. *Aero Digest*, Vol. 54, No. 5, May, 1947, pp. 78–80, diagrs.

The pneumatic system of an aircraft consists of a pressure system that operates the flight instruments. Both the pressure and the vacuum are supplied by an engine-driven vacuum pump or pumps. The air intake is through a vacuum relief valve and through the suction lines to the instruments. The compressed air passes through oil filters, regulators, and pressure-relief valves to the air distribution valve and then to the deicer boots. Maintenance of the system is simple. It consists principally of cleaning the lines with compressed air, checking the valve settings, cleaning the oil separators, and testing the cycle of operation of the deicer boots. The vacuum part of the system should be checked for sufficient pressure drop to actuate the instruments, and fittings should be checked regularly.

Production—General

Nipponese Nightmare. S. Paul Johnston. *The Technology Review*, Vol. 49, No. 7, May, 1947, pp. 398–400, 436, 438, illus.

The U.S. Strategic Bombing Survey has shown that Japanese industry failed for lack of both long- and short-range planning. The decision to disperse factories underground came too late. The movement lacked organization and was inefficient. In contrast to the German subterranean dispersal which was well planned, efficient, and effective, the Japanese attempt resulted in industrial suicide. The national defense plans of our country should include long-range planning for such a contingency. Now in peacetime, pilot underground factories should be built in order to discover and solve the actual problems that may face us.

Bavarian Motor Works (BMW)—A Production Survey. H. C. Haskell. *Combined Intelligence Objectives Sub-Committee, Item Nos., 5, 26, File No. 30-80.* 65 pp., illus. British Information Services, New York. $1.75. A review of the activities of this manufacturer of reciprocating and gas-turbine engines, including descriptions of the engines and the factories.

The Aircraft Works of Koninklijke Maatschappij "De Schelde" at Flushing and Breda. R. H. Fagan, R. Purves, and others. *Combined Intelligence Objectives Sub-Committee, Item No. 25, File No. 9-5, 6, 7, 11-22.* 67 pp., figs. British Information Services, New York. $1.90.

Descriptions of the plant layout and production methods used during the occupation in producing wings for German Dornier 24 flying boats, and how the facilities were dispersed following a successful bombing by the allied forces.

Weser Flugzeugbau. H. E. Weihmiller and H. P. Meiners. *Combined Intelligence Objectives Sub-Committee, Item No. 25, File No. 31-10*, July 14, 1945. 9 pp., illus. British Information Services, New York. $0.55. Report of the production activities of several plants engaged in building FW 190 fuselages, assembling Ju 87 airplanes, and other aircraft. Production charts from 1936 to 1945 are reproduced.

Report on Visit to Daimler-Benz A.G. at Stuttgart-Untertürkheim. P. Joseph. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 35, Item No. 26.* 33 pp., tables. British Information Services, New York. $1.00. Activities of the eleven plants operated by the concern are reported from the economic point of view, with production figures and comments about the factors affecting those figures.

Production Methods

Tooling the Convair 240. G. F. Gerhauser. *Aero Digest*, Vol. 54, No. 5, May, 1947, pp. 81–83, 140, illus.

For maximum interchangeability of units the aircraft is divided into 18 major components. The fuselage constant-section fixture is the major reference jig to which all the fixtures for other units must accommodate. The production-line assembly stations are listed and described.

Precision Building of Convair-240's for Low-Cost Maintenance. G. F. Gerhauser. *Machinery*, Vol. 53, No. 10, June, 1947, pp. 180–184, illus.

Aircraft Engines of Tomorrow in Production Today. I. Charles H. Wick. *Machinery*, Vol. 53, No. 10, June, 1947, pp. 138–145, illus. A description of the tooling and machining operations performed on the magnesium- and aluminum-alloy parts of an Allison gas turbine.

Cylinder Production for the "Wasp Major" Engine. T. J. Crowley and F. J. Carney. *Machinery*, Vol. 53, No. 10, June, 1947, pp. 152–159, illus. A description of the multiple-station transfer and the special finning machines that are used by Pratt & Whitney in machining forged aluminum-alloy cylinders.

Tests on Casting Processes for Aero-Engine Bearings with Lead-Bronze Liners: A New Casting Process for Aero-Engine Bearings with Double Lead Bronze Liners. Rossmer. (*Fürstlich Hohenzollernsche Hüttenverwaltung*, Laucherthal, July 14, 1939.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC-3C/21T.* 32 pp., figs.

Description of extensive tests on bearings with double and single lead-bronze liners made by the dipping process. This process made it possible to cast approximately 15 to 20 bearings per hour per 100 kg. per crucible, in only two operations. The liner, the steel jacket, and the bond between the two were found to be satisfactory. The only difficulty encountered was the difference in the type of cooling required by the alloy and by the steel.

Bushings from Steel Wool Made by North American Aviation. Charles O. Herb. *Machinery*, Vol. 53, No. 10, June, 1947, pp. 164–167, illus.

Steel wool, after it has been annealed, is compressed into a ribbon and wound on an arbor. It is then further compressed into a ring the size of the required bushing. A coil of wire is placed inside the ring and subjected to heat. Capillary attraction draws the copper throughout the entire structure producing, in effect, a porous copper bearing.

Precision Machining and Heat-Treating of Aircraft-Engine Gears: Precautions Taken by the Wright Aeronautical Corporation to Eliminate Inaccuracy and Distortion During Machining, Heat-Treating and Casehardening of Aircraft Reduction Gears. Vallory H. Laughner. *Machinery*, Vol. 53, No. 10, June, 1947, pp. 168–173, illus.

Flash-Welding Tubular and Solid Parts for Lockheed Planes. Fred C. Pipher. *Machinery*, Vol. 53, No. 10, June, 1947, pp. 160–163, illus. Adoption of this method for elements ranging in cross section from 3 to 0.035 sq.in. resulted in less than $^1/_{10}$ of 1 per cent rejections.

"Press-Welding" Aluminum for Aircraft Radiators. T. G. Haertel. *U.S., Field Information Agency, Technical, Final Report No. 417*, November 8, 1945. 8 pp., illus. British Information Services, New York. $0.55.

Sheets of aluminum were virtually melted together between gas-heated dies closed under pressure. While the dies were nearly closed, compressed air was injected between the sheets to blow open the areas between the rows of welds in order to form passageways conforming to the design of the dies.

A Method for Welding Sheet Aluminum to SAE 4140 Steel. W. F. Hess and E. F. Nippes, Jr. *U.S., N.A.C.A., Advance Restricted Report No. 4A01 (Wartime Report No. W-102)*, January, 1944. 53 pp., figs. 9 references.

Forming Aluminum Sheets into High-Strength Structures. Bernhard Rogge. *Machinery*, Vol. 53, No. 10, June, 1947, pp. 174–179, illus.

Use of this method of reinforcing aluminum-alloy sheets with a series of formed ridges crossing each other at right angles, forming a waffle-bead pattern, can result in a 60 per cent saving in the cost of reinforced panels. The mold can be cast either in plaster of Paris or in printer's type-metal or can be machined from masonite. Using a technique similar to that employed with a deep-draw die, the sheet is formed to 95 per cent of the full depth. It is then heat-treated and the resulting distortion removed by drawing the metal to the full depth of the die depression.

Hot Dimpling and Joggling 75S-T for the DC-6's. Floyd E. Bryan and Don E. Bailey. *Machinery*, Vol. 53, No. 10, June, 1947, pp. 146–151, 189, illus.

The shaping of 75S-T aluminum alloy was found to be impossible at room temperatures. The use of heated joggle dies was adopted to raise the temperature of the metal in the vicinity of the bend to from 300° to 325°F. With this method the alloy was found to be as satisfactory as 24S-T aluminum alloy and permitted a weight reduction of 800 lbs. per aircraft.

Bending Heavy Spar Caps. P. F. Girard. *Western Flying*, Vol. 27, No. 5, May, 1947, p. 28, illus.

Ryan Aeronautical Co. has taken advantage of the high ductility of 75S-T aluminum alloy at 300°F. in forming spar caps that have a cross-sectional area of 7 sq.in. The spar, which is set on kirksite rocker blocks and heated by induction, is formed in a hydraulic press.

Propellers

The Aims and Problems of Aerodynamic Research on Airscrews, Which, in the Opinion of V.D.M., Are of Immediate Importance. Karl N. Kramer. (*V.D.M. Aeronautics Dept., Report LAE-2 (Special Report No. 76)*, March, 1942.) *Gt. Brit., Ministry of Supply, RTP/TIB Translation No. GDC-3E/11T.* 9 pp. 13 references.

An analysis of the problems of propeller design facing the aircraft designer at the time of writing. The influence of the compressibility of the air, laminar profiles, and the influence of installation of the propeller are each developed to point out the gaps existing in research and the directions the solution may take.

Braking of the Aircraft by the Airscrew. Josef Stueper. (*E/BIOS/Gp. 2/HEC. 10*, 1944.) *U.S., Army Air Forces, Translation No. F-TS-830-RE*, May, 1947. 71 pp., illus.

Variation of the propeller pitch can fulfill all the requirements of an air brake. In braking during the landing run, the pitch change would have to be at the rate of 30° per sec. In flight, braking would require a rate of change of only 10° per sec.

Propeller Selection from Aerodynamic Considerations. John L. Crigler and Herbert W. Talkin. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. L-363)*, July, 1942. 31 pp., figs. 6 references.

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The Effect of Pitch on Force and Moment Characteristics of Full-Scale Propellers of Five Solidities. Jack F. Runckel. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-446)*, June, 1942. 65 pp., figs. 5 references.

Some Effects of Propeller Operation on the Distribution of the Load on the Vertical Tail Surface of a Typical Pursuit Airplane. Harold H. Sweberg and Richard C. Dingeldein. *U.S., N.A.C.A., Restricted Bulletin No. 4C13 (Wartime Report No. L-426)*, March, 1944. 27 pp., figs. 2 references.

Radio and Electronics

The Electric Strength of Antenna Installations in Airplanes Operating at High Altitudes. H. Mehlhardt. *(ZWB/FB/Re/849*, July, 1937.) *U.S., Army Air Forces, Translation No. F-TS-1106-RE*, May, 1947. 15 pp., figs. 17 references.

Safe operation of an antenna installation is limited by the initial voltage at which a discharge (glow or ionization) appears. The value of this voltage, which is determined by the characteristics of the installation and by atmospheric conditions, is inversely proportional to the altitude, decreasing 22.5 per cent at 16 km. To compensate for these atmospheric effects the antenna equipment may be installed in a pressure-type cabin and may be heated either electrically or by the exhaust gas.

Reception Interference in Airplanes at 50-Cm. Wavelength W. Becker. *(ZWB/FB/983*, October, 1938.) *U.S., Army Air Forces, Translation No. F-TS-1502-RE*, May, 1947. 7 pp., figs. 1 reference.

The only additional noise suppression required for reception in the 50-cm. band is the shielding of the high-speed regulators of the d.c. generators. Standard shielding practice has been found to be effective.

Adaptation and Bandwidth of FuG-216 Antenna. Maurer and F. Berndorfer. *(ZWB/UM/4001*, July, 1943.) *U.S., Army Air Forces, Translation No. F-TS-1044-RE*, April, 1947. 11 pp., illus.

Impedance diagrams for antenna-matching, calculation of longitudinal induction, frequency-response, and horizontal radiation curves are given for the FuG-217. The circuit of the adapter and directions for choosing the best adapter-setting are included. The FuG-216 (Neptune R) is an air-borne radar warning device. The FuG-217 is an improved model which has more frequency bands and greater range.

Radar and Controlled Missiles, Paris Area. N. D. Crane. *Combined Intelligence Objectives Sub-Committee, Item No. 1, File No. 1-1.* 63 pp., figs. British Information Services, New York. $1.75.

Investigations of French factories producing equipment for the Germans during the occupation revealed no significant or radical changes in German designs. French engineers and technicians were instructed only about manufacturing details. Equipment and operations of the plants are reported.

Cathode-Ray Presentation of Three-Dimensional Data. Otto H. Schmitt. *Airborne Instruments Laboratory, Inc., Mineola, N.Y., Report No. 931-1*, March, 1947. 36 pp., figs.

The principles of projective and perspective drawing and stereoscopic photography can be applied to cathode-ray presentation and produce from the basic electrical data recognizable three-dimensional pictures. This is essentially a visual presentation of three related quantities that vary simultaneously, and all are a function of still another parameter.

The Properties of Magnetic Metals and Powdered-Iron Cores at High Frequencies. D. Moehring. *(ZWB/FB/938/6.)* *U.S., Army Air Forces, Translation No. F-TS-1047-RE*, March, 1947. 35 pp., illus. A recapitulation of the results of the most important works on the measurements of magnetic materials to obtain a general picture of permeability.

Rotating Wing Aircraft

Full-Scale Investigation of the Aerodynamic Characteristics of a Typical Single-Rotor Helicopter in Forward Flight. Richard C. Dingledein and Raymond F. Schaefer. *U.S., N.A.C.A., Technical Note No. 1289*, May, 1947. 47 pp., illus. 5 references.

Simulated forward-flight conditions in the Langely full-scale tunnel showed that at a thrust coefficient of 0.0060 a rotor more accurately and permanently contoured than the production rotor required an average of 13 per cent less power at air speeds from 44 to 60 m.p.h. At any thrust coefficient the improved rotor gave a substantial reduction in the power required, because of lower profile-drag losses. Additional but smaller power savings were realized in operation at higher thrust coefficients. An average of 3.5 per cent less horsepower was required in flight at a rotor speed of 200 r.p.m. (thrust coefficient, 0.0060) than at 219 m.p.h. (thrust coefficient, 0.0050).

The XR-10, built for the U.S. Army Air Forces by Kellett Aircraft Corporation, is the first twin-engined transport-type helicopter in the world. Two 525-hp. Continental engines drive two counter-rotating, intermeshing, three-bladed rotors of 65 ft. diameter. The XR-10 can carry a crew of two and ten passengers or 2,000 lbs. of cargo. Maximum speed is over 100 m.p.h.; range, almost 350 miles.

FA 223 Helicopter; Interview with Prof. Focke and Inspection of Machine. Bartram Kelley and Hugh J. Mulvey. *U.S., Field Information Agency, Technical, Final Report No. 178*, October 1, 1945. 12 pp., figs. British Information Services, New York. $0.55. Description of the complete German machine and its components, with details of the construction of the rotor, controls, engine installation, and landing gear.

Flettner Helicopter FL 282 "Kolibri." Bartram Kelley and Hugh J. Mulvey. *Combined Intelligence Objectives Sub-Committee, Item No. 25, File No. 31-11.* 22 pp., illus. British Information Services, New York. $1.00. Detailed description of a German helicopter having two intermeshing two-blade rotors, tricycle landing gear, and substantial tail surfaces.

Advancing Helicopter Technology. Alexander Klemin. *Aero Digest*, Vol. 54, No. 5, May, 1947, pp. 86, 87, 152, 154, illus. A review of seven papers read at the Third Annual Helicopter Forum of the American Helicopter Society in Philadelphia.

Seaplanes and Flying Boats

Effect of Length-Beam Ratio on the Aerodynamic Characteristics of Flying-Boat Hulls. Campbell C. Yates and John M. Riebe. *U.S., N.A.C.A., Technical Note No. 1305*, June, 1947. 41 pp., illus. 5 references.

Aerodynamic tests of a family of flying-boat hulls, in which the product of the beam and the square of the length is constant, were made in order to determine the effect of the length-beam ratio. The investigation indicated a reduction in minimum drag coefficient of 0.0022 (29 per cent) with fixed transition when length-beam ratio was extended from 6 to 15. Minimum drag occurred at angles of attack from 2° to 3°. Increase of length-beam ratio increased the hull longitudinal stability by an amount corresponding to the rearward shift of the aerodynamic center. This change at an angle of attack of 2° increased the variation of the yawing-moment coefficient with the angle of yaw from 0.0009 to 0.0014. Incorporating a hull step fairing, which extended longitudinally about nine times the depth of the step at the keel, resulted in a reduction of up to 16 per cent in the minimum drag coefficient.

Theoretical Motions of Hydrofoil Systems. Frederick H. Imlay. *U.S., N.A.C.A., Technical Note No. 1285*, June, 1947. 76 pp., diagrs. 6 references.

A development of theoretical methods of treating the motions of hydrofoil systems and determining some of the important

WHEN EXTREME TEMPERATURES CALL FOR A COMBINATION OF PROPERTIES

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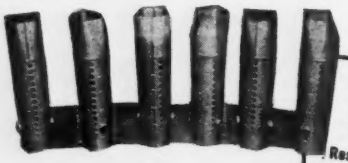

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- Resistance to thermal shock.
- Resistance to progressive oxidation.
- Resistance to corrosion at high temperatures.
- Fabricability and weldability.

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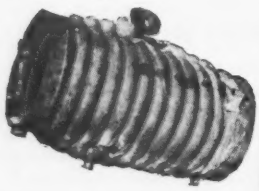
1. In designing jet engines to power America's newest, fastest pursuit planes, engineers chose Inconel* for the combustion chamber liner assemblies, as shown above. In all, 45 lbs. of .031" gauge Inconel strip is used per engine. Inconel's resistance to thermal shock plus its workability and weldability were important reasons why it was chosen for this demanding job.



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- Corrosion resistance at high temperatures.
- Heat transfer.
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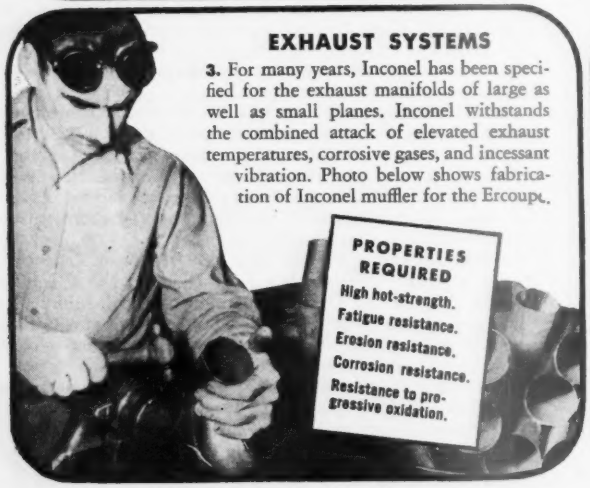

PROPERTIES REQUIRED
- High hot-strength.
- Fatigue resistance.
- Erosion resistance.
- Corrosion resistance.
- Resistance to progressive oxidation.

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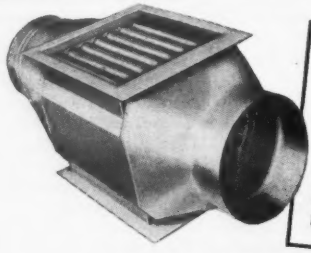
3. For many years, Inconel has been specified for the exhaust manifolds of large as well as small planes. Inconel withstands the combined attack of elevated exhaust temperatures, corrosive gases, and incessant vibration. Photo below shows fabrication of Inconel muffler for the Ercoupe.



PROPERTIES REQUIRED
- Heat transfer.
- Corrosion resistance.
- Resistance to thermal shock.
- Fabricability.
- Fatigue resistance.
- Light weight.

DE-ICING EQUIPMENT

4. This McQuay heat exchanger, made entirely of Inconel, withstands the thermal shock of sub-zero intake air, and hot corrosive exhaust gases. Inconel also has strength to permit lightweight construction. Its ready workability enables it to be fabricated into the various parts required by this unit.

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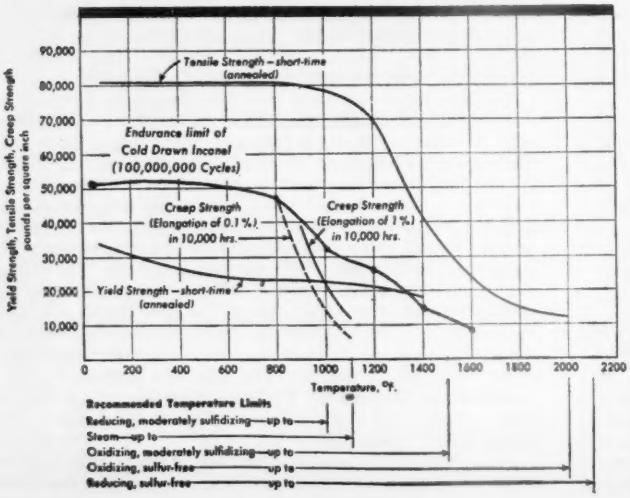

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parameters. Variations of parameters include three distributions of area between the hydrofoils, two rates of change of down-wash angle with angle of attack, three depths of immersion, two dihedral angles, two rates of change of lift with immersion, three longitudinal hydrofoil spacings, two radii of gyration in pitching, various horizontal and vertical locations of the center of gravity for stable emotion, values of stability roots, and motions following the sudden application of a vertical force or a pitching moment to the hydrofoil system for numerous sets of values of parameters.

The Porpoising Characteristics of a Planing Surface Representing the Forebody of a Flying-Boat Hull. James M. Benson. *U.S., N.A.C.A., Advance Restricted Report* (*Wartime Report No. L-479*), May, 1942. 26 pp., figs. 4 references.

General Porpoising Tests of Flying-Boat-Hull Models. F. W. S. Locke, Jr. *U.S., N.A.C.A., Advance Restricted Report No. 3117* (*Wartime Report No. W-96*), September, 1943. 33 pp., figs. 17 references.

Stress Analysis and Structures

Column Characteristics of Sandwich Panels Having Honeycomb Cores. W. W. Troxell and H. C. Engel. *Journal of the Aeronautical Sciences*, Vol. 14, No. 7, June, 1947, pp. 413–420, illus. Discussion, pp. 420, 421. 5 references.

The column characteristics of panels having metal faces and honeycomb cores are reviewed. Compression behavior is shown to be determined by the elastic properties of the face metal and by the shear rigidity of the stabilizing medium. A theory of column behavior which considers the shear rigidity of the core and the reduced elastic properties of the face material at stresses above its elastic limit is developed and shown to be in accord with experimental data. Optimum panel construction—i.e., the ratio of face thickness to total thickness—which yields the maximum strength-weight ratio, is discussed and related to a loading parameter that measures the intensity of loading on the structure. Comparison of the structural efficiency of honeycomb panels with metal construction shows the sandwich to be the less efficient simple column. However, it is pointed out that this computation ignores the advantage of the transverse stiffness of the sandwich which comes into play in square panels or in those that are relatively long, parallel to the direction of loading, and narrow transversely.

Elastic and Plastic Bending of Beams. Tsun Kuei Wang. *Journal of the Aeronautical Sciences*, Vol. 14, No. 7, July, 1947, pp. 422–432, figs. 10 references.

A method of analyzing fiber stresses of beams, which includes the full effect of nonlinear stress-strain characteristics of materials throughout the elastic and plastic range of bending. Various shaped cross sections commonly encountered in aircraft practices are considered. A new term, "norstress," is proposed for the measurement of remote fiber stresses of cross sections of beams under pure bending. Equations are derived for the norstress on rectangular, box, channel, I, Z, _⊓_, L, T, circular, and tubular beams. A stress-strain formula is also recommended for use of calculations of integrals involved in the stress and moment equations, as well as for drawing stress-strain curves in the absence of test data.

An Analysis of the Compressive Strength of Honeycomb Cores for Sandwich Constructions. Charles B. Norris. *U.S., N.A.C.A., Technical Note No. 1251*, April, 1947. 15 pp., figs. 2 references.

A formula that expresses the relation between the compressive strengths of honeycomb cores that have the same cell shape but which differ in size of the cell and in thickness of the cell wall reduces considerably the amount of testing necessary to evaluate the effectiveness of various fibrous materials from which honeycomb cores are made. This analysis is partly empirical, using data obtained from tests of plywood panels. It has been applied successfully to honeycombs made from resin-impregnated papers but should be verified before being applied to materials differing greatly from these.

Bending Stresses Due to Torsion in a Tapered Box Beam. Edwin T. Kruszewski. *U.S., N.A.C.A., Technical Note No. 1297*, May, 1947. 48 pp., illus. 2 references.

A method of calculating the bending stresses caused by torsion in a tapered box beam. A special taper is assumed in which all flanges, if extended, would meet at a point. Recurrence formulas developed for use in this calculation are included. Experimental results showed good agreement with calculated results.

The Compressive Strength of Short Circular Tubes. I. G. Bowen. *Aircraft Engineering*, Vol. 19, No. 218, April, 1947, pp. 128, 129, figs. 5 references.

Test results indicate that a formula more accurate than that of Douglas for the collapsing stress in compression of medium or thick tubes can be derived by plotting the stress ratio (collapsing stress in compression/ultimate tensile stress) against the wall-thickness/tube-radius ratio.

Critical Shear Stress of Curved Rectangular Panels. S. B. Batdorf, Manuel Stein, and Murry Schildcrout. *U.S., N.A.C.A., Technical Note No. 1348*, May, 1947. 29 pp., diagrs. 13 references.

One of a series of papers on the buckling of a curved sheet. The critical shear stress of a cylindrical curved rectangular panel is determined. The problem is solved theoretically for panels having simply supported edges. Computed curves are provided for finding the critical shear stress. Estimated results are also given for curved rectangular panels have clamped edges. The theoretical solution for simply supported rectangular panels is based on small-deflection theory. The experimental results were in good agreement with the theory when it was defined in such a way as to be rather insensitive to local imperfections.

Joints in Flat Panels Subjected to Shear and Combined Shear and Tension. F. W. David and J. Solvey. *Aircraft Engineering*, Vol. 19, No. 218, April, 1947, pp. 119–124, figs. 9 references.

This paper deals with incomplete tension fields, and establishes the stresses in the mid-plane of the sheet and the loads acting on the panel joints. It is an attempt to provide a direct method for the design of joints and to assess the panel stresses for any given external loads. This mathematical development results in a rivet joint design which is based not on the ultimate or yield load of the panel but on the actual load to be carried through the joint.

A Simplified Method of Elastic-Stability Analysis for Thin Cylindrical Shells. II—Modified Equilibrium Equation. S. B. Batdorf. *U.S., N.A.C.A., Technical Note No. 1342*, June, 1947. 33 pp., diagrs. 15 references.

The derivation of an equation equivalent to that of Donnell but adapted to the solution of the equilibrium of thin cylindrical shells with clamped edges, as well as shells having simply supported edges. This retains the ease and simplicity of solution of Donnell's equation. The boundary conditions implied by the method of the modified equation are discussed.

Stresses in Streamline Shells Due to Unsymmetrical Loading. A. M. Binnie. *Aircraft Engineering*, Vol. 19, No. 218, April, 1947, pp. 125, 126, figs.

The formulas derived by Timoshenko for the stresses in a shell caused by gravity or acceleration acting in the direction of the axis of symmetry can be extended further to give a formula for the stresses caused by the weight of the shell when the axis is horizontal. This method can be extended further to include concentrated loads that do not exert a twisting action on the shell.

The Strength and Stiffness of Shear Webs With and Without Lightening Holes. Paul Kuhn. *U.S., N.A.C.A., Advance Restricted Report* (*Wartime Report No. L-402*), June, 1942. 44 pp., figs. 4 references.

The Longitudinal Shear Strength Required in Double-Angle Columns of 24S-T Aluminum Alloy. Paul Kuhn and Edwin M. Moggio. *U.S., N.A.C.A., Restricted Bulletin No. 3E08* (*Wartime Report No. L-427*), May, 1943. 11 pp., figs. 6 references.

Effect of Normal Pressure on the Critical Shear Stress of Curved Sheet. Normal Rafel. *U.S., N.A.C.A., Restricted Bulletin* (*Wartime Report No. L-416*), January, 1943. 12 pp., figs. 1 reference.

An Improved Method for Calculating the Dynamic Responses of Flexible Airplanes to Gusts. Abbott A. Putnam. *U.S., N.A.C.A., Technical Note No. 1321*, May, 1947. 22 pp., diagrs. 4 references.

Comparison of test results on a semirigid model indicates that this is an improved method of calculating the time histories of wing deflection and acceleration increments without impairing the accuracy of the calculation of maximum values. The solution of the basic equations for the unit-jump forcing function and a chart for determining a suitable forcing function for a given gust materially reduces the time necessary for making a set of calculations of the dynamic response of the wings of a conventional airplane to a gust.

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Failure Sequence Indicator. Richard W. Powell. *Aero Digest*, Vol. 54, No. 6, June, 1947, pp. 62, 63, 135, figs.

To test the development and progress of failures in compression tests, fine wires with the same failure strength as the material are cemented to the specimen. Each of these wires is used to short one of a bank of condensers in series with a battery. As each wire ruptures, the corresponding condenser becomes charged. The first condenser charged will have the highest potential, and each succeeding charge will be smaller. Since the sum of the voltages on the condensers is equal to the battery voltage, the ratio of the condenser voltages will indicate the order in which the wires ruptured and, consequently, the progress of the failure in the test specimen.

The Application of a "Wattmeter" Harmonic Analyser to the Measurement of Aerodynamic Damping for Pitching Oscillations. J. B. Bratt, K. C. Wight, and V. J. Tilly. *Gt. Brit., Aeronautics Research Council, Reports and Memoranda No. 2063*, May 27, 1942. 21 pp., figs. 8 references.

A method in which the modulated output from a magnetostriction stress indicator is first rectified and then analyzed electrically by means of an electronic watt-meter. The results are obtained in terms of the meter readings. This method is more sensitive than the photographic method and has revealed certain undesirable features in the stress indicator, e.g., hysteresis in the sensitive unit and somewhat rapid variation of the calibration with time.

Fatigue-Testing Machine. B. J. Lazan. *Machine Design*, Vol. 19, No. 5, May, 1947, pp. 123–127, illus. 5 references.

The requirements for a universal machine for specimen and simulated service tests are enumerated. A below-resonance, centrifugal-force type of machine with inertia-force compensation has been designed by the Sonntag Scientific Corp. and built by the Baldwin Locomotive Works. The alternating force for the vibrating system is supplied by an eccentrically supported mass driven by a synchronous electric motor through a flexible shaft. A repeated constant force, rather than a repeated constant deflection, is imposed. Static preload is applied through calibrated springs, which also absorb the inertia force produced by the vibratory motion of the cage and attached parts. The attachment and operation of fixtures for simple and combined stresses are explained. The functioning of the inertia-force compensator spring is analyzed mathematically.

Wind Tunnels and Laboratories

Tunnel Interference at Compressibility Speeds Using the Flexible Walls of the Rectangular High-Speed Tunnel. C. N. H. Lock and J. A. Beavan. *Gt. Brit., Aeronautical Research Committee, Reports and Memoranda No. 2005*, September 27, 1944. 37 pp., figs. 14 references.

Experiment is compared with theory for the wall pressures when the walls are straight—i.e., set so as to have no pressure gradient in the empty tunnel—and for the wall shapes required to give constant pressures on the walls when the airfoil is present. A sufficient order of accuracy, for both the original and the proposed method of streamlining the walls, is obtained to permit the assumption of free-air conditions about an airfoil in two-dimensional tests. Only when a shock wave on the airfoil has grown to such an extent that it reaches the wall of the tunnel is this assumption invalidated.

Flow Structure and Pressure Recovery in Supersonic Tunnels. H. Eggink. (*ZWB, Forschungsbericht Nr. 1756*, January 18, 1943.) *Cornell Aeronautical Laboratory*, Buffalo, May, 1947. 25 pp., illus. 5 references.

A form of the compression shock that is found in supersonic nozzles is described as a function of the Mach Number and the nozzle form as shown in schlieren photographs. In order to obtain supersonic flow in the test section of a nozzle-test-section diffuser, the minimum diffuser cross section must be considerably larger than the minimum nozzle section because of the pressure losses in the shock which moves downstream through the nozzle when the flow is established. A free jet requires a larger section than the closed tunnel. The best pressure recovery is obtained when the compression shock is at the narrowest constriction of the diffuser. Pressure recovery from a compression shock falls off sharply as the Mach Number increases. A diffuser with a double constriction in which the shock would be located in the narrower cross section, where the Mach Number is lower, would improve the recovery.

Effect of Critical Mach Number and Flutter on Maximum Power Loading of Ducted Fans. Arthur A. Regier, John G. Barmby, and Harvey H. Hubbard. *U.S., N.A.C.A., Technical Note No. 1330*, June, 1947. 38 pp., diagrs. 7 references.

Calculations and test results show that the ideal or design lift coefficient of an airfoil is almost the same as the lift coefficient giving the maximum flutter speed. Therefore, in order to obtain the maximum power loading, a ducted fan should be operated at the ideal lift to get high critical speeds and the maximum margin of safety with respect to flutter.

High Speed Tunnels and Other Research in Germany. A. Thom and G. P. Douglas. *Combined Intelligence Objectives Sub-Committee, Item No. 25, File No. 28-47*. 38 pp., figs. British Information Services, New York. $1.15.

Techniques and methods of correction used in large subsonic wind tunnels were studied, and the results achieved are reported. The favorable power factor of the German wind tunnels is attributed to their greater diffuser length. That and the large power available have made it possible to use a higher density and, consequently, a higher Reynolds Number. The extensive amount of fundamental work done on airfoils, shock waves, boundary-layer stability, and other research is described, as well as the design and construction of the tunnels and their equipment.

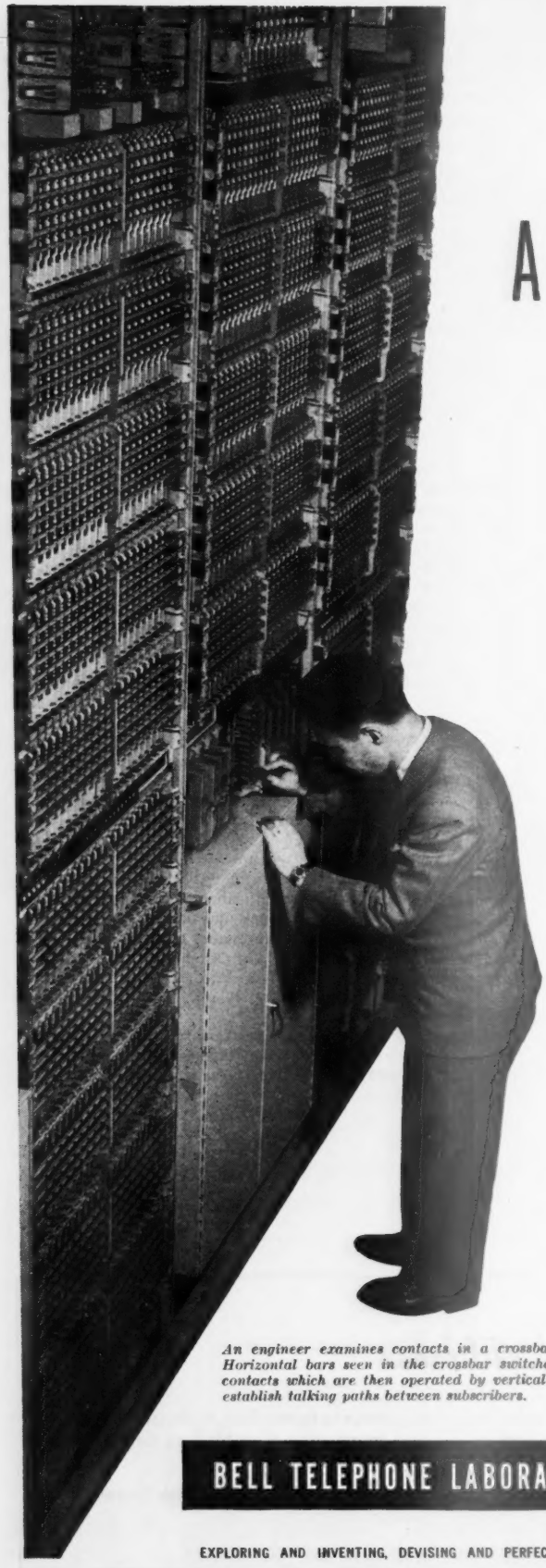
Luftfahrtforschungsanstalt Hermann Göring, Volkenrode, Brunswick. R. D. Hiscocks, J. L. Orr, and J. J. Green. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 160, Item Nos. 2, 25, 26*. 42 pp. British Information Services, New York. $1.30.

Report on the centralized research facilities maintained by the German Ministry of Aircraft Production, including institutes for the study of aerodynamics, structures, materials, engines and weapons, and flight research hangars, workshops, and service buildings.

Changes of Address

Since the Post Office Department does not as a rule forward magazines to forwarding addresses, it is important that the Institute be notified of changes in address 30 days in advance of publishing date to ensure receipt of every issue of the *Journal* and *Review*.

Notices should be sent directly to the Institute of the Aeronautical Sciences, 2 East 64th Street, New York 21, N. Y.



An engineer examines contacts in a crossbar office. Horizontal bars seen in the crossbar switches select contacts which are then operated by vertical bars to establish talking paths between subscribers.

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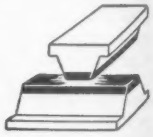

Outcome of this long research is a bar-shaped contact welded to the switch and positioned at right angles to its mate. For most applications, an inexpensive base is capped with precious metal.

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Books

The Right To Fly. John C. Cooper. New York, Henry Holt and Co., 1947. 380 pp. $5.00.

Defining air power simply as the ability of a nation to fly, the author in this book includes implications of air power which go far beyond the idea of military air power. Transport in the airspace is not an easy concept to absorb in a world long accustomed to ideas based on surface transportation. It is pointed out that the sovereignty of each nation over its airspace has, since the Peace Conference in Paris in 1918–1919, been an accepted principle governing the organization of international aviation. But the capacity of a nation to act in the airspace is even more important, and neither sovereignty nor the capacity to act can be separated one from the other. Control of the airspace over Germany and over Japan is as essential to the successful conclusion of the peace negotiations as control over the military potential. By considering the total aviation activity of a nation, civilian and military, as its air power and by analyzing the international law of aviation through a detailed grasp of its history and present status, the author has written a timely and useful book. In the last three chapters, the relative strength of the great powers, both actual and potential, is analyzed. Twelve global charts accompany these chapters, four for Russia, four for the United Kingdom, and four for the United States. The texts of the following documents are given in six appendixes: Paris Convention (1919); The Nine Rules (1922); Application of Treaty Article 198 (1926); Chicago Convention (1944); International Air Services Transit Agreement (1944); International Air Transport Agreement (1944). The bibliography is comprehensive. The author was a practicing lawyer from 1911 to 1934, when he became Vice-President of Pan American Airways, Inc. He is now with the Institute for Advanced Study at Princeton University. He has served on a number of committees and commissions concerned with international aviation law. His conclusions are well worth the attention of a wide audience.

The Flow Around Turbine and Compressor Blades. F. Weinig. Translated by Max Hartenheim. (Germany, 1935.) Washington, U.S. Navy Department, Bureau of Ships, Research and Standards Branch, May, 1946. 173 pp., figs.

All of the books reviewed and listed are in the I.A.S. Library and may be borrowed without charge, except for certain reference books. Application for loans should be made to The Paul Kollsman Lending Library, 2 East 64th Street, New York 21, N.Y.

A straight profile theory is developed which gives a closer approximation in calculating the design of blades for axial-flow compressors and turbines than has been possible heretofore by using the methods of Shilhansl, Weinel, and Betz. The theory is developed for the effect of a plane grid on a flow and extended to a series of buckets. The special cases of finite thick profiles and thin vanes are considered, and formulas are derived for the design of a blade for given conditions of flow and velocity distribution. Some of the theoretical foundations for the design procedures of Eckert and others are included. This preliminary translation, which has been issued without an index or a detailed table of contents, is published pending a revision to be undertaken by Dr. Chester W. Smith of the General Electric Co. In spite of some places where the diction is not the best and the word order or phraseology may tend to obscure the meaning, the translation is, on the whole, good, and in its present form it should be of great practical value to designers of axial compressors.

Aircraft Engines. A. W. Judge. Vol. 2. 2nd Edition, Revised and Enlarged. London, Chapman and Hall, Ltd., 1947. 493 pp., illus. 36*s*.

The preface to this second edition states that, in revising the original work published in 1941, all the new material has been arranged in the last chapter, No. XIII. Certain modifications were also made in the preceding chapters in the course of revision. These modifications are fully as important as the compendium in the last chapter, for they bring each individual topic up to date and make this an outstanding text on power plants. Volume 2 illustrates and supplements Volume 1, which deals primarily with the theory and the experimental aspects of aircraft engines. But this does not lessen the value of this volume as a self-sufficient work. Aircraft power plants are presented not as isolated products but in their proper place in the history of the development of engine theory and design. The first three chapters on general design, torque and balance, and type of engine include sufficient theory to raise the book from the purely descriptive level and to make it an excellent survey text on engine design.

The chapter on recent developments and trends is comprehensive in its treatment of advances in superchargers, weight-output ratio, and gas turbines. Each item treated is integrated into the body of existing knowledge and takes on the character not of a "new" development but of another step in the growth of our knowledge. The section on gas turbines lists eleven advantages of this system, compares them with a list of disadvantages, and tells of the research being undertaken to overcome these disadvantages. Many of the German developments that have come into our hands are mentioned not under the by-line of the firm now exploiting them but as the product of the concern that was originally responsible for that development. The chapter on sleeve-valve engines gives a good example of the treatment used throughout the entire book. The principles of operation of the double-sleeve-valve engine are illustrated by the Knight engine of 1905 and its French development by Gabriel Voisin, who produced a seven-cylinder radial air-cooled engine in 1935. Another four pages are devoted to the single-sleeve-valve engine originally designed in 1907. Two figures show the part arrangement and the valve port openings. Twenty-two more pages discuss the development and application of this type of engine. Comparison graphs of performance and starting characteristics and illustrations of the parts of the single-sleeve engine and the poppet-type engine form part of the text.

The index is comprehensive, including not only trade names but also principles and systems. A key to text references, containing 92 items, documents the text.

Elementary Fluid Mechanics. John K. Vennard. 2nd Edition. New York, John Wiley & Sons, Inc., 1947. 339 pp., diagrs., figs. $4.00.

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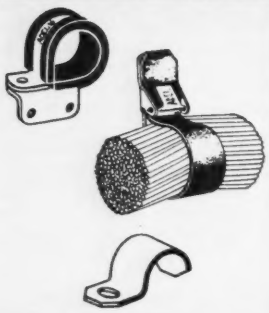

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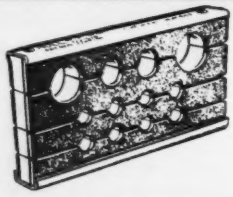

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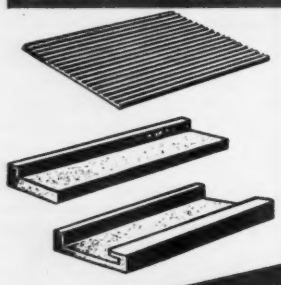

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The author, who is Associate Professor of Fluid Mechanics at Stanford University, has maintained the overall plan of the first edition, which was to present an introductory textbook for the student who knows the principles of mathematics and mechanics. Much new material has been added and some deleted. The original chapter entitled "Ideal Fluid Flow" has been expanded to three chapters, dealing with the incompressible fluid, the compressible fluid and the impulse-momentum law. The chapter on pipeline flow has been modernized. There is a longer discussion of practical pipeline problems and a different approach to the boundary layer. Discussions of the effect of velocity distribution on velocity head and the development of the method for the calculation of critical depth in nonrectangular channels have been added. Problems have been made more analytical and illustrative problems less routine. Mathematical developments have been condensed, and material has been deleted when it was found that it was too advanced, was treated adequately in other fields, dealt with obsolete devices, or interrupted the continuity of the book. The changes have made possible a book that is shorter but which covers more material than the first edition.

Mechanical Vibrations. J. P. Den Hartog. 3rd Edition. New York, McGraw-Hill Book Co., Inc., 1947. 478 pp., figs. $6.00.

The principal changes in this revised edition of a standard text concern subjects in which recent advances have been made, such as airplane wing flutter, helicopter ground vibration, torsional pendulum dampers, singing ships' propellers, and electronic instruments. The number of problems has been increased. In presenting the subject, the author has not avoided mathematics, but in all cases the mathematical approach used is the simplest one available. The author is Professor of Mechanical Engineering at the Massachusetts Institute of Technology and during the war served in the Bureau of Ships of the U.S. Navy.

International Air Transport, 1947 London, Todd Reference Books, Ltd.; distributed by Geo. G. Harrap & Co., Ltd., 1947. 473 pp., illus. 21*s*.

The first two issues of this yearbook were published under the title *Air Transport and Civil Aviation*. The present edition has been expanded to cover a wider field. There are brief articles by authorities on British civil aviation prospects, the need for research, catering and passenger welfare, airscrews and their future development, transport aircraft, aerial surveying, refueling in flight, and legislation and policy. About four-fifths of the book is a directory of international organizations; government agencies; civilian organizations; air lines; latest transport aircraft; organizations interested in air transport; a who's who in international air trans-

port; a list of books, periodicals and films; personnel of aviation committees, both civilian and governmental, of the United Kingdom; a section of statistics for air transport; and a list of airports of the world used by air-transport companies. There is much in this reference work which cannot be easily located elsewhere. The addresses given are specific, and for most organizations, Government agencies, and air lines there is a statement of their aims, policies, and work. The book has a large amount of data relating to transport aviation in the countries of the world and can be recommended as the best available directory of aeronautics in the United Kingdom and other countries.

Bomber Offensive. Sir Arthur Harris. London, Collins, 1947. 288 pp. $5.00.

Sir Arthur Harris was appointed Commander-in-Chief of the Bomber Command in February, 1942. He had been in England since 1939, first as Air Officer commanding No. 5 Bomber Group, then as Deputy Chief of the Air Staff. The greater part of this book is concerned with the bombing offensive of the British Bomber Command from the time preparations began in 1942 until the victory in 1945. In 1942, of the small bomber force of 378 aircraft serviceable with crews, only 69 were heavy bombers, and there was only a fraction of the men and equipment needed for the offensive planned. Radar aids to navigation were just beginning to appear. The technique of enemy radar-jamming had yet to be developed. It would be months before bombing could be conducted on the scale of the 1,000-plane attack on Cologne. Sir Arthur's account of the building of the bomber force, the development of its equipment, and the ultimate daily mass bombings of enemy production centers carries authority and will be a valuable source book. The conclusions at the end of the volume are stated in characteristically specific terms. A single service, not a three-part military service, is essential for modern times. The atomic bomb is a flexible weapon not necessarily dependent upon aircraft. If there were a war within the next quarter of a century, it would destroy a great part of the civilized world. World federation is the alternative to this. The modesty of the author is apparent throughout, but there also is no doubt of his opinion on the matters under discussion.

Mechanical Measurements by Electrical Methods. Howard C. Roberts. Pittsburgh, The Instruments Publishing Co., Inc., 1946. 357 pp., illus. $3.00.

The author, who is Special Research Associate Professor at the University of Illinois Engineering Experiment Station, has written a clear and comprehensive explanation of the principles and operation of electrical instruments for measuring mechanical properties and forces. He has collected in this volume much important information that appeared in various languages and was scattered heretofore in the literature of many fields. This survey should be a useful handbook for the engineer in solving his practical problems, as well as an introduction for the inquiring reader. The material in Part I was published originally in serial form in *Instruments* magazine and has been revised to bring it up to date at the time of publication. Part I contains chapters on the general principles of operation; gaging methods based on variations of capacitance, inductance, and resistance; photoelectric, piezoelectric, thermoelectric, acoustic, and other methods; bridge and potentiometer circuits; and indicating and detecting instruments. Calibrating devices, calibration-checking circuits, oscillographs, power supplies, amplifiers and computing devices, and complete gaging systems are covered in the second section. There is a classified bibliography of about 120 references, a detailed subject index, and a list of the 321 references cited as footnotes in the text, arranged alphabetically by subject.

Other Books Received

AERODYNAMICS

Investigations of Compression Shocks and Boundary Layers in Rapidly Moving Gases. J. Ackeret, F. Feldman, and N. Rott. (Zürich, Eidgenössische Technische Hochschule, Institut für Aerodynamik, Mitteilung Nr. 10, 1946.) Buffalo, New York, Cornell Aeronautical Laboratory, December, 1946. 69 pp., figs. (Cf. AER 3/47:43.)

AIR TRANSPORT

The Development, Operation, and Regulation of the Non-Scheduled Air Carrier. Washington, U.S. Civil Aeronautics Administration, May 26, 1947. 11 pp. The report indicates that 15 per cent of 3,600 nonscheduled operators are doing 90 per cent of the business. The conclusion is reached that the nonscheduled carriers will carry a steadily diminishing portion of domestic passenger and freight traffic during 1947 as scheduled air lines push sales and improve their facilities. No attempt is made to analyze the growth of the strictly contract carrier. Safety and economic regulations for nonscheduled traffic are discussed.

What is ICAO? Montreal, International Civil Aviation Organization, May, 1947. 28 pp., illus. Following a brief review of a quarter of a century of progress in international civil air transport, this booklet gives details about the organization, development, and objectives of the International Civil Aviation Organization, the work it has been carrying out, and its relations with other international organizations.

Sea-Air Abroad: A Report on the Participation of Foreign Steamship Interests in International Air Transport. Richard H. Wels. Washington, Sea-Air Committee, 1947. 63 pp. The author of this report is special counsel to the Sea-Air Committee, which is composed of American steamship companies that are seeking authorization to operate air transport services over the ocean trade routes. His description of the way foreign countries are using the sea-air combine in competing with the United States for world markets is based on a two months' examination of the civil aviation systems of Western Europe, with particular attention to those of Scandinavia, the Low Countries, France, the Iberian Peninsula, and Great Britain. There is a chapter on United States air-lines operations in Europe. The conclusions reached are summarized.

Air Cargo. Eric Rath and G. L. Knight, Jr. (Report No. 25.) New York, News Background, 1947. 41 pp. $2.00. A study that envisions what advances in air-freight service will do for America. The report emphasizes the importance of developing new business methods, such as smaller inventories and quicker turnovers. Some of the subjects discussed include the cost of shipping by air freight; terminal handling operations; scheduled, nonscheduled, contract, and foreign carriers; rates; the clearance of international cargo; Government regulation, and the marketing of air freight.

AIRPLANE DESIGN

British Civil Airworthiness Requirements. Vol. I. London, Air Registration Board, 1946. Loose-Leaf. These are the normal minimum requirements on which the Air Registration Board will base its recommendations to the Ministry of Civil Aviation. The requirements are confined to the basic airworthiness, with which is involved the minimum equipment considered essential for airworthiness of stated categories. The requirements are presented in sections devoted to general information and procedures; the requirements for propellers, engines, airplanes, and radio; and definitions.

AIRPORTS

Decker's Airport Guide. Zones 1–5. 1947 Edition. Fairfield, Conn., Decker Air Services, Inc., 1947. 5 vols. $2.00 per vol.; $8.00 the set. The guide lists the facilities of each airport; the availability of meals, lodging, and transportation; and the points of interest in the immediate vicinity. Also included is information on gasoline taxes, Civil Air Regulations, and the location of weather bureaus. There is a volume for each of the five geographical zones of the United States: the Pacific, the North Central, the South Central, the North Atlantic, and the South Atlantic zones.

London Airport: Report of Layout Panel. Gt. Brit., Ministry of Civil Aviation. London, H. M. Stationery Office, 1946. 8 pp., folding maps. 2*s*. British Information Services, New York, $0.70. Recommendations for an international civil airport at Heathrow are presented. The report discusses the nature of the site, fundamental principles affecting the layout, dimensions and clearances, runway capacity, runway separation, runway patterns, building and maintenance areas, and the final overall plan.

Airport Electrification. London, The General Electric Co., Ltd., of England, December, 1946. 49 pp., illus. Recommendations for the proper selection and use of airport electrical equipment manufactured by the General Electric Co. Lighting equipment, lighting control, radio communication, radar and navigational aids, broadcast call equipment, telephone communications, ground traffic control, power equipment, and airfield lighting layout are discussed. The proposals are made on the basis of a three-runway airport for an important terminal.

ATOMIC ENERGY

Atomic Challenge. William A. Higginbotham and Ernest K. Lindley. (Headline Series No. 63.) New York, Foreign Policy Association, Inc., 1947. 63 pp., diagrs. $0.35. The first section, "Splitting the Atom," outlines the structure of the atom, describes how energy is obtained through splitting the nucleus, and discusses uses of atomic energy. The second section, "Harnessing the Atom," is a discussion of the international control of atomic energy.

Explaining the Atom. Selig Hecht. New York, The Viking Press, 1947. 205 pp., illus. $2.75. A book for the layman outlines what has been learned about the atom and explains why it produces energy when split.

BEARINGS

Symposium on the Testing of Bearings. Forty-Ninth Annual Meeting, A.S.T.M., Buffalo, June 24–28, 1946. Philadelphia, American Society for Testing Materials, 1947. 65 pp., illus., diagrs. $1.50. Reprints of five papers entitled: Life Testing of Plain Bearings for Automotive Engines, by E. T. Johnson; Fatigue Testing Machines for Ball and Roller Bearings, by Thomas Barish; Metallographic Observations of Ball Bearing Fatigue Phenomena, by A. B. Jones; Fatigue Testing of Roller Bearings, by H. R. Gibbons; and Testing of Bearings Under Controlled Load, by J. M. Frankland and C. B. Innes.

BUSINESS AND FINANCE

Results of Air Market Data Service First Annual Nationwide Survey of Aircraft Owners, Spring, 1946. Dallas, Texas, Air Market Data Service, 1946. 41 pp. (Supplement to Air Market Data Service Aviation Report, which is available on subscription at $150 per year.) A statistical analysis of replies from aircraft owners as obtained through questionnaires sent out to determine the number of planes they own and other information such as the makes of planes owned, planes owned in the past, and the income brackets of owners. The replies are separated into five classifications and into five geographical regions. The five classes are: (1) private individuals and business concerns owning aircraft; (2) persons engaged in some phase of the aviation industry who own and operate an airplane only for pleasure or some nonaviation function; (3) private owners who share the expense of ownership by selling flying time, rental, or instruction; (4) aircraft sales and service operators whose full income is not derived from their aviation operations; and (5) full-time aircraft sales and service operators.

ECONOMICS

America's Needs and Resources. J. Frederic Dewhurst and Associates. New York, The Twentieth Century Fund, 1947. 812 pp., figs., tables. $5.00. This comprehensive study presents a careful estimate of America's human and industrial capacity and resources balanced against the probable needs and demands for 1950 and 1960. The volume is intended to serve as a fact book of the American economic system and as an information guide to the future. Incorporated in it are data and information about the aviation industry and estimates of its future requirements. Analyses are made of the trends in air-line passenger transportation, the air market, future airport requirements, past and estimated future expenditures for aviation, etc. Because the volume covers so many fields, the aviation information is widely scattered.

FLIGHTS

Alone over the Tasman Sea. Francis Chicester. London, George Allen & Unwin, Ltd., 1945. 314 pp., illus., maps. 10*s*. This book, first published in 1933 under the title of "Seaplane Solo," is an adventure story written by a man who became one of England's well-known writers on air navigation. It tells how, in the days when practical astronomical air navigation was in its infancy, he flew a seaplane across the Pacific from New Zealand to Australia with only a small sextant, a pocket chronometer, and an old book of nautical tables to give him the calculations without which it would have been impossible to reach land.

FUELS AND LUBRICANTS

Symposium on Oil Procurement Practices. Forty-Ninth Annual Meeting, A.S.T.M., Buffalo, June 24–28, 1946. Philadelphia, American Society for Testing Materials, 1946. 53 pp., illus., diagrs. Of the seven papers presented at the meeting, "Airline Oil Procurement Practices," by J. T. Hendren, is of particular interest. The oil procurement procedures of a large air line are outlined in detail, and the need for improved methods of aviation oil evaluation is pointed out.

Forum on Diesel Fuel Oils. Sponsored by Technical Committee F of Committee D-2 on Petroleum Products and Lubricants, A.S.T.M., November 13, 1946. (Technical Publication No. 71.) Philadelphia, American Society for Testing Materials, 1947. 38 pp., figs., tables. $0.75. Reprints of eight papers presented at a forum that provided an opportunity for consumers and producers of Diesel fuels and the manufacturers of Diesel equipment to discuss their problems. Most of the material has no direct application to aviation, but a paper on "Postwar Military Trends," by G. H. Vogel, includes some remarks on future fuel requirements for jet power plants.

GLIDING AND SOARING

Soaring in America. Elmira, N. Y., The Soaring Society of America, Inc., 1947. 20 pp., illus. A brochure published to stimulate interest in gliding and soaring. It discusses the use of sailplanes for sport, research and experimental work, training, and transport. It gives information about the operation of gliders and the requirements of the Soaring Society of America for gliding and soaring certificates.

JUVENILE

Mutiny in the Air. James M. Downie. London, Blackie & Son, Ltd., 1947. 255 pp., illus. 4*s*. A group of English schoolboys touring the Empire in a four-engined monoplane see the captain marooned on a desert island and find themselves held for ransom by a notorious gangster.

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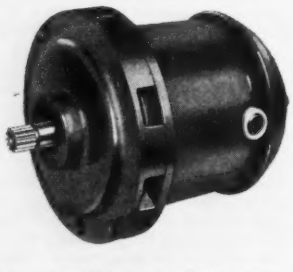

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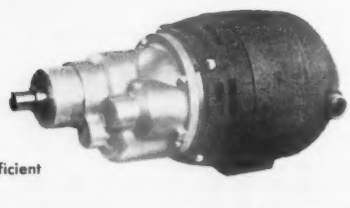

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MANAGEMENT

Organization and Management in Industry and Business. 3d Edition. William B. Cornell. New York, The Ronald Press Company, 1947. 819 pp., illus., diagrs. $5.00. Extensive revisions have been made in this edition to bring the presentation of the subject into line with the up-to-date practices of progressive modern companies. The text is based on the author's experience in teaching courses on the organization and management of industrial and business concerns and is intended for use in schools of commerce and engineering. Part I is devoted to the organization and operation of a business enterprise; Part II, to production control and time study; and Part III, to illustrations from practice.

MATHEMATICS

Introduction to the Theory of Equations. Lois W. Griffiths. New York, John Wiley & Sons, Inc., 1947. 278 pp. $3.50. This book is intended for students with a background of plane trigonometry, analytic geometry, and differential calculus. Some of the subjects covered include binomial equations, cubic and quartic equations, the roots of polynomial equations, determinates, systems of linear equations and determinates, complex numbers, and symmetric functions. There are a short bibliography and a list of answers to the problems presented.

Unified Calculus. Edward S. Smith, Meyer Salkover, and Howard K. Justice. New York, John Wiley & Sons, Inc., 1947. 507 pp., figs., tables. $3.50. In writing this course in calculus, which is intended for students who have completed the freshman year, the authors have aimed at unification of the various branches of the subject. Through the interweaving of fundamental ideas of differential and integral calculus, treated in early chapters, the student is enabled to gain an appreciation of the essential unity of the subject. Problems of definite integrals and applications have been interspersed throughout the chapters that deal with formulas and methods of integration. For the purpose of strengthening the correlation of calculus with physics and mechanics, the principles of integration introduced in the early part of the book are applied to centroids and moments of inertia in addition to area, volume, liquid pressure, and work.

METALS AND ALLOYS

An Introduction to Aeronautical Engineering. Vol. 3—Properties and Strength of Materials (Metals). J. D. Haddon. London, Sir Isaac Pitman & Sons, Ltd., 1946. 192 pp., illus., figs. 8*s.* 6*d.* This is the third volume of a series prepared to help those who are engaged in practical aeronautical engineering and who require at least an elementary knowledge of the theory underlying their work. The author discusses the principal metals used in aircraft and explains the methods of determining the sizes of the members from the loads they must sustain. As in the previous volumes of the series, the aim has been to produce a book that, while avoiding the use of higher mathematics, is correct and up to date. Where the book is used as an introduction to more advanced work, a study of calculus is advised, and it is noted that the work on continuous beams may appear too advanced to some readers. The more important changes in this edition were made in the discussions of nitriding, normal stress, torsion test, principal stresses, Wagner beam, and elastic instability of struts.

Powder Metallurgy: Principles and Methods. Henry H. Hausner. Brooklyn, Chemical Publishing Co., Inc., 1947. 307 pp., diagrs., figs. A book written for engineers and others interested in this relatively new branch of metallurgy. To aid in the explanation of the principles of powder metallurgy, tables and graphs are used extensively. The author describes the methods of manufacturing metal powders and commercially available metal powders and their applications. He discusses the relationship between physical properties of the metal compact, such as density, hardness, strength, electrical and magnetic properties, and the various steps of the powder metallurgical process. A glossary on powder metallurgy is included. An important feature is a chronological bibliography containing 1,064 references to the literature.

Symposium on Atmospheric Weathering of Corrosion-Resistant Steels. Presented at the Forty-Ninth Annual Meeting, A.S.T.M., Buffalo, June 24–28, 1946. Philadelphia, American Society for Testing Materials, 1946. 85 pp., illus., figs., tables. $1.50. Reprints of papers entitled Atmospheric Corrosion Tests on High-Chromium Steels; Corrosion-Resistant Steel for Architectural and Structural Applications; Atmospheric Corrosion Tests of Corrosion-Resistant Steel; Weathering Behavior of Corrosion-Resistant Steel Insect Screens; and Results of 15 Years' Exposure Tests on Corrosion-Resistant Steels. The discussion following the reading of the papers is included.

METEOROLOGY

Meteorological Handbook for Pilots and Navigators. 2d Edition. (Gt. Brit., Meteorological Office, Publication No. 448 (Air Publication No. 1931) 1942.) London, H. M. Stationery Office, 1946. 104 pp., illus. 2*s.* 6*d.* British Information Services, New York. $0.90. A guide to elementary meteorology. This is a comprehensive and simple manual written for the preflight student and intended to give familiarity with weather forecasting, reporting, and terminology. The meteorological service of the R.A.F. is outlined and the codes used in reporting are illustrated. The book is well indexed and contains a glossary of common meteorological terms.

PATENTS

Inventions, Patents, and Monopoly. Peter Meinhardt. London, Stevens & Sons, Ltd., 1946. 352 pp. 25*s.* Written to aid those requiring an understanding of the spirit and purpose of the patent law, this book is divided into four sections. In Part I an analysis is made of the influence on the community of inventors and the inventions they produce. The growth and development of the modern patent system is treated in Part II. The author shows how the history of patents has accurately reflected the course of industrial development in Great Britain. Part III deals with the abuse of patent rights. In Part IV the author presents suggestions for patent-law reform.

PHYSICS

Essentials of Applied Physics: A Foundation Course for Technical, Industrial, and Engineering Students. Royal M. Frye. New York, Prentice-Hall, Inc., 1947. 322 pp., illus. $4.35. This text is the outgrowth of the author's long experience in teaching physics to students in engineering schools. Numerous topics not found in a preparatory course are included. Modern points of view on light are employed, but the advantage of the wave theory is retained. There is a clear and concise description of the various systems of engineering and absolute units. The practical electric units are used in the text instead of the two centimeter-gram systems of units. As a preparation for this, the kilogram-meter-second system, as well as the English system of units, is used in the treatment of mechanics. Also, the kilogram-calorie is used instead of the gram-calorie. Definitions of technical terms and problems for solution are given at the end of each chapter.

Wave Propagation in Periodic Structures: Electric Filters and Crystal Lattices. Leon Brillouin. New York, McGraw-Hill Book Company, Inc., 1946. 239 pp., diagrs. $4.00. Constituting one of the International Series in Pure and Applied Physics, this volume contains a wide variety of wave propagation problems, extending from electrical engineering to electromagnetism and wave mechanics of the spinning electron. The author points out in the preface that the link connecting this variety of problems is found in their common mathematical background; that waves always behave in a similar way, whether they are longitudinal or transverse, elastic or electric; and that this general philosophy of wave propagation, forgotten for a time, has been strongly revived in the last decade and represents the backbone of his book. Much of the material is based on lectures delivered by the author at the Collège de France, Paris, and at the University of Wisconsin.

Time, Knowledge, and the Nebulae. Martin Johnson. New York, Dover Publications, 1947. 189 pp., illus. $2.75. An introduction to the meanings of time in physics, astronomy, and philosophy, and the relativities of Einstein and Milne. The book is a first attempt to draw out some of these meanings, inspired by Milne's new relativity, which suggests that many puzzles in astronomy and atomic physics might become clarified if recognition is given to more than one way of using time in physics. It is written not merely for the research specialist but also for the practical scientist or student. However, it is not a book that will appeal to those uninterested in detailed analytical reasoning and philosophic discussion. Two appendixes contain information for the aid of readers who do not have a background in advanced science. There is a foreword by Professor Milne, President of the Royal Astronomical Society.

PLASTICS

Plastics Mold Design. Carrol C. Sachs and Eugene H. Snyder. New York, Murray Hill Books, Inc., 1947. 77 pp., illus., fold. diagrs. $4.50. Written by a consulting engineer for plastics and a research engineer of the Lockheed Aircraft Corp., this volume, which includes 14 full-sized working drawings of the different types of molds and dies discussed in the text, provides the engineer, tool designer, and industrial designer with detailed information on plastic molds. Aware of the divergence of opinion as to the best method of molding certain parts and the best mold design, the authors have drawn on their long experience in the industry and the experience they gained in World War II and have written a text that should be a valuable aid to those having to do with the design and manufacture of molds and dies for plastics. When teaching plastics courses during World War II, they found that examples of completely dimensioned working drawings of the molds used were not available for instruction purposes. The drawings supplied with the text are complete with dimensions and tolerances and are suitable for use by students, apprentices, and experienced workers. The subject is treated in six parts which cover drafting-room practice, materials for mold construction, compression-mold design, injection-mold design, transfer-mold design, and extrusion-die design.

Modern Plastics Encyclopedia. New York, Plastics Catalogue Corp., 1947. 3 vols. $8.50 the set. This encyclopedia covers the whole field of plastics and plastics manufacture and contains much material pertinent to the aviation industry. Because of the expansion of the plastics industry and the widening field of plastics applications, it has been necessary to condense some of the older information. Some features of the 1947 edition, which is presented in three volumes, include charts on the properties of fibers and low-pressure laminating resins; three articles and a chart on sheet and film; information on resin treatment for fabrics; data on the optical properties of plastics; a bibliography of reports on German plastics; and articles on continuous low-pressure and cellulose-derivative laminates, pulp and solvent moldings, heat-sealing and cementing of thermoplastics, and transfer presses. Each article includes references to other material on the subject. Further sources of information are given in a short selected bibliography.

PRODUCTION

Records for the Control of Growing Manufacturing Enterprises. Paul F. Lawler. Boston, Harvard University, Graduate School of Business Administration, 1947. 131 pp. $1.00. Based on the actual practices of companies engaged in manufacturing, this is a report on research into methods of keeping and using records as carried out by organizations employing not more than

300 people. Part I presents certain general conclusions reached from interviews with 37 companies. Part II deals with specific records used in controlling the various functions of a business, such as production control and purchasing. Typical routines for getting information from one department to another are reported. Each function is examined from the angle of the information needed, the findings in the company studied, and the author's comments. The commentaries offer suggestions for improving the preparation of records and augmenting their usefulness.

SCIENCE

You and the Universe: What Science Reveals. John J. O'Neil. New York, Ives Washburn, Inc., 1946. 328 pp. $3.50. The book provides the layman with a general understanding of the present state of scientific knowledge of the world in which he lives. It is composed entirely of material written by the author for the *New York Herald-Tribune*. There are two sections, one devoted to man and the other to the universe. The author describes in easily understood language outstanding discoveries and remaining problems in astronomy, physics, geology, biology, mathematics, chemistry, anthropology, zoology, medicine, and psychology.

SPECTROCHEMICAL ANALYSIS

Report on Standard Samples for Spectrochemical Analysis, 1947. Compiled by A.S.T.M. Committee E-2, Subcommittee IV on Standards and Pure Materials. (Technical Publication No 41-B.) Philadelphia, American Society for Testing Materials, 1947. 23 pp., tables. $1.25. The results of a new survey of available standard samples for spectrographic analysis. Sections of the report are devoted to standard samples for iron and steel; aluminum and its alloys; magnesium and its alloys; and miscellaneous materials including ceramic materials, steel-making alloys, ores, refractories, and synthesized mixtures, salts, and solutions.

Index to the Literature on Spectrochemical Analysis. Part II, 1940–1945. Bourdon F. Scribner and William F. Meggers. Philadelphia, American Society for Testing Materials, 1947. 180 pp. $3.00. This is an extension to the previously published index on the subject, Part I, 1920–1939. Brief abstracts of more than 1,000 items published from 1940 to 1945 are included. Thirty-six references for the years 1938 and 1939 that were omitted from Part I are included also. The references are arranged alphabetically by author under the year of publication. There is a subject index to the entire volume.

VALVE GEARS

Valve Gear Design. Michael C. Turkish. Detroit, Eaton Manufacturing Co., Wilcox-Rich Div., 1946. 130 pp., figs. $6.00. A mathematical treatise on the design of valve gear mechanisms. Harmonic, contracted harmonic, and triple curve contours are analyzed for cams using flat followers. For cams using roller or shoe followers, specifications are given for harmonic, contracted harmonic, expanded harmonic, secant flank, expanded secant flank, and tangential contours. A section is devoted to tables for cam design. A short chapter outlines the techniques and instruments used in observing and recording the actual motion of the valve gears.

WORLD WAR II

Air Force Diary. James H. Straubel. New York, Simon and Schuster, Inc., 1947. 492 pp. $3.75. A group of 111 stories about the experiences and heroic deeds of some of those who fought with the U.S. Army Air Forces during World War II. Selected from the pages of *Air Force Magazine*, official service journal of the Army Air Forces, these articles provide a graphic picture of the progress of the war in the air as seen by those who took part in it.

Saga of the All American. Edited by W. Forrest Dawson. Atlanta, Albert Love Enterprises, 1946. 400 pp., illus. This volume tells the story of the 82nd Airborne Division. The book consists of collections of illustrated articles describing the organization and training of the Army's first airborne division, its operations and achievements in the European Theatre in World War II, and the life and experiences of its officers and men. Six pages are devoted to statistical information including the casualties in different combat areas, awards, a summary of the time spent in combat areas, and a list of the units attached to the Division.

Contrails, My War Record; A History of World War Two as Recorded at U.S. Army Air Force Station #139, Thorpe Abbotts, near Diss, County of Norfolk, England. New York, John F. Callahan Associates, Inc., 1947. 292 pp., illus. A record of the activities and achievements of the 100th Bombardment Group (H), the 83rd Service Group, the 456th Sub-Depot, and the 412th Air Service Group in World War II. There is a foreword by General of the Army Henry H. Arnold. This volume describes how the units were organized, equipped, and trained and the part they played in the prosecution of the war. It is extensively illustrated.

Jungle Pilot. Barry Sutton. London, Macmillan & Co., Ltd., 1946. 127 pp. 6*s*. The story of a fighter pilot who was a squadron commander in the small R.A.F. element that first fought side by side with the "Flying Tigers" of the American Volunteer Group, and then fought by itself against the Japanese air force that operated in a series of sweeps against Allied airfields before the fall of Rangoon.

I.A.S. National Meeting Schedule

Joint Meeting, Royal Aeronautical Society—London, England—September 2–6, 1947

Wright Brothers Lecture— Washington, D.C.—December 17, 1947

Sixteenth Annual Meeting—New York—January 27–29, 1948

Members or organizations wishing to submit papers for presentation at National Meetings should send outlines or summaries to the Committee at least 3 months prior to the meeting.

All papers submitted will be considered for publication in the *Journal of the Aeronautical Sciences* or the *Aeronautical Engineering Review*.

All correspondence should be addressed to The Meetings Committee, Institute of the Aeronautical Sciences, 2 East 64th Street, New York 21, N.Y.

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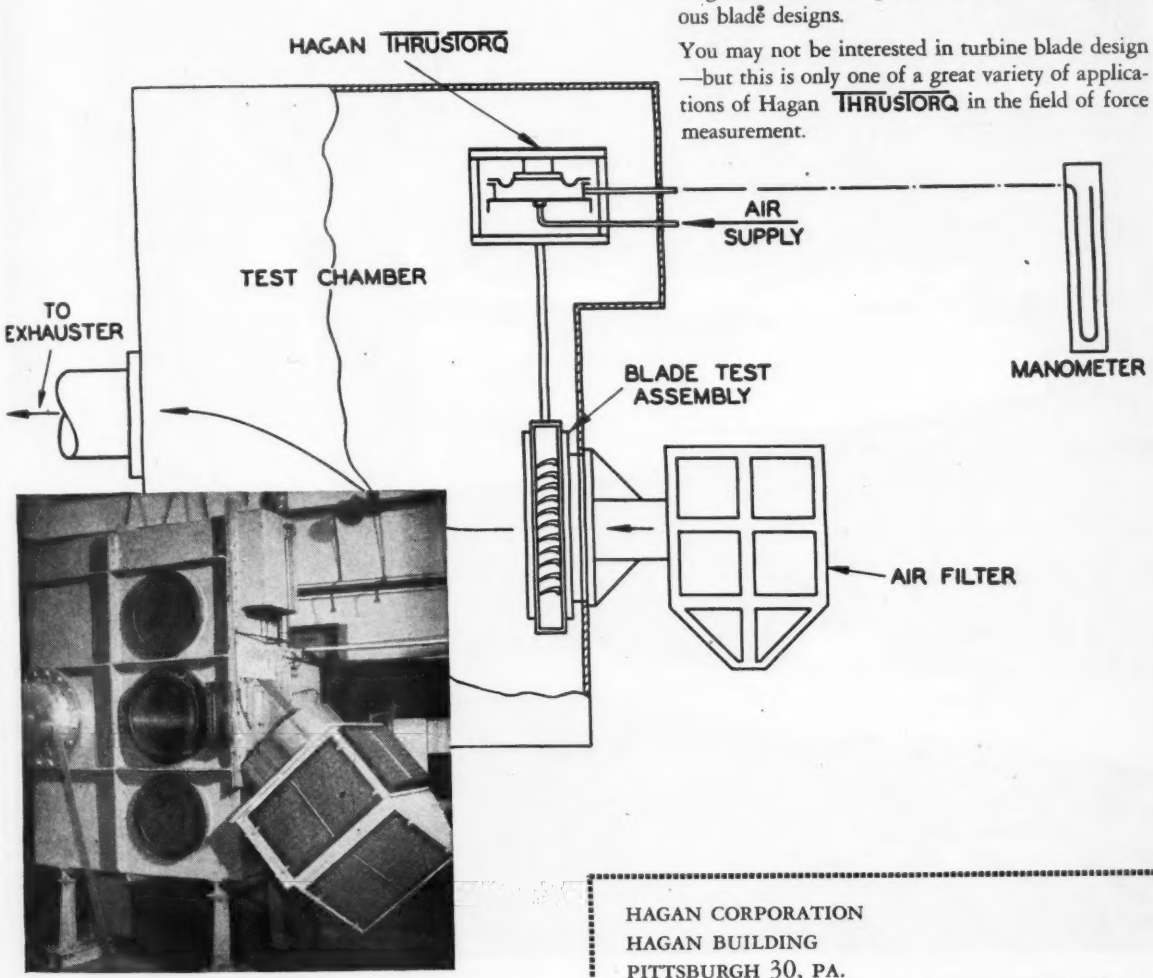

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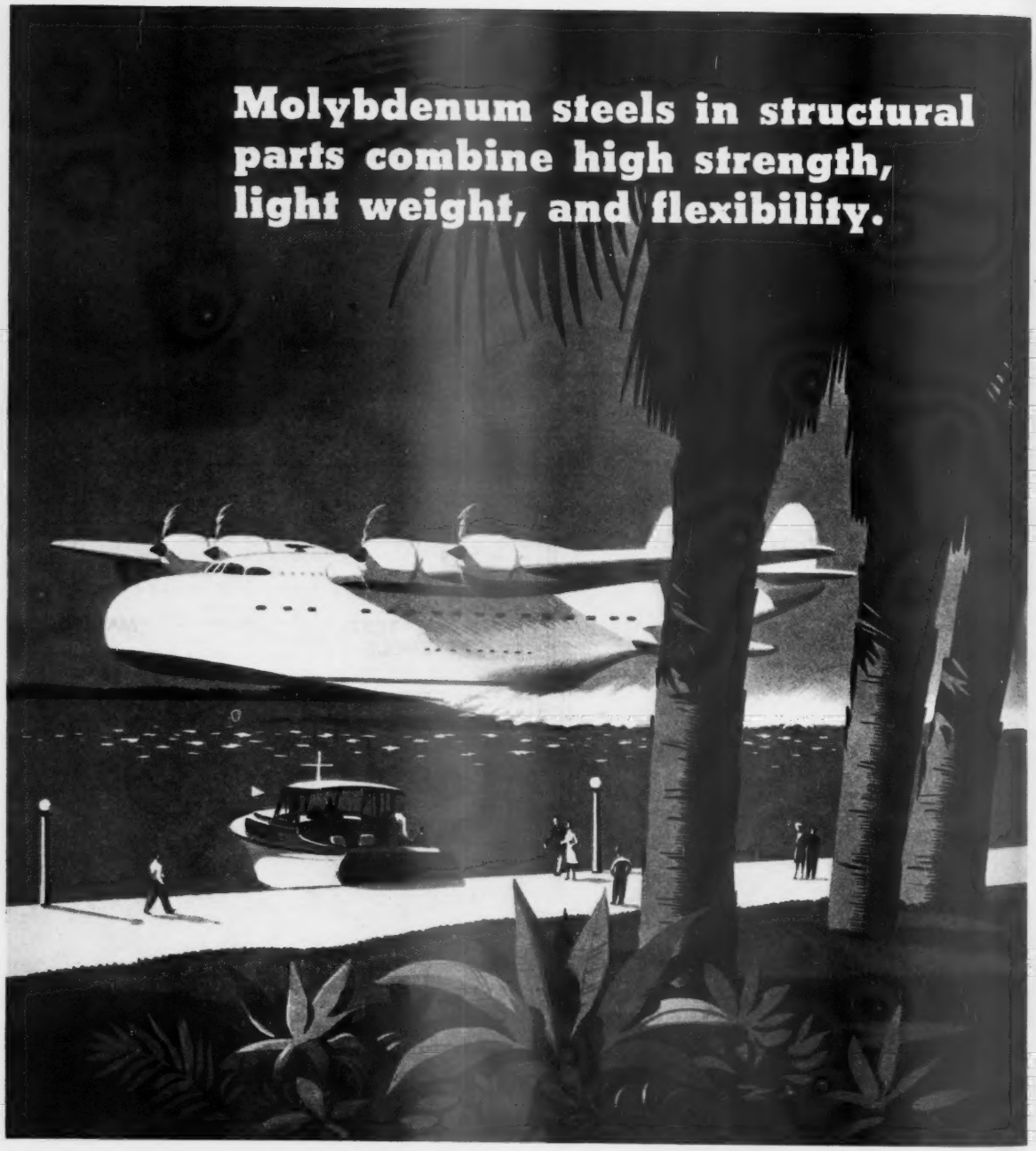

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Personnel Opportunities

This section is for the use of individual members of the Institute seeking new connections and organizations offering employment to aeronautical specialists. Any member or organization may have requirements listed without charge by writing to the Secretary of the Institute.

WANTED

Structural Designers—Engineers experienced in design of sheet-metal structures desired for large cargo aircraft project. Graduate engineers preferred. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Layout Draftsmen—Six or more years' experience in aircraft layout and design. Cargo aircraft experience desired. Graduate engineers preferred. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Stress Analysts—Personnel with experience on sheet metal, monocoque, cargo-type aircraft desired. Graduate engineers with 5 or more years' experience preferred. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Chief Aerodynamicist—Services of highly qualified person to act as chief aerodynamicist. All applicants must be graduate engineers of recognized universities. Experience on cargo or large type of aircraft desirable. Applicants should write, giving complete details of education and experience, list references and salary expected, as well as availability. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Aerodynamicists—Several positions open to qualified personnel for performance and load calculations on cargo-type aircraft. Graduate engineers preferred with at least 5 years' experience. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Engineers—Attention newly graduated engineers: Opportunities for wide-awake hustlers who want to learn. Write, giving full particulars of scholastic record and any experience, to Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Assistant Professor—Assistant Professor of Aeronautical Engineering wanted to teach junior and senior courses at Oregon State College. A man with graduate degree, teaching and industrial experience preferred. Address replies to B. F. Ruffner, Oregon State College, Corvallis, Ore.

Educators and Specialists—Pacific Northwest opportunity for aeronautical educators and engineering specialists. Advanced degree required, plus enthusiasm for graduate teaching and research. Excellent laboratory facilities available. Address inquiry to Aeronautical Engineering Department, University of Washington, Seattle 5, Wash.

Aerodynamicist—Person familiar with calibration of and testing procedures in high-speed wind tunnels to direct these activities on a new tunnel. Reply should contain information concerning education, experience, and when available and should be addressed to the Employment Office at Cornell Aeronautical Laboratory, 4455 Genesee Street, Box 235, Buffalo 21, N.Y.

Controls Engineer—Experienced, for development of controls and valves associated with large rocket propulsion systems in guided missiles program. Desired background: electrical or mechanical engineering degree and minimum of 5 years' experience in the practical development of valves, servomechanisms, and automatic controls. Address reply to Engineering Personnel Office, North American Aviation, Inc., Municipal Airport, Los Angeles 45, Calif.

Research Engineers and Physicists—Engineers, physicists, chemists, and mathematicians with research experience in problems related to aeronautics are needed by the National Advisory Committee for Aeronautics. Salaries for various positions requiring research experience range from $3,397 to $9,975 per year, depending on the type and level of work. Entrance positions for college graduates pay $2,644 per year. Areas of research include the following: aerodynamics, hydrodynamics, structures, materials, thermodynamics, compression and turbines, fuels and combustion, lubrication, mathematics, optics, electronics, radar, telemetering, servomechanisms, and other fields. Applications for positions or requests for further information should be addressed to the personnel officer at one of the following laboratories: Langley Memorial Aeronautical Laboratory, Hampton, Va.; Ames Aeronautical Laboratory, Moffett Field, Calif.; Aircraft Engine Research Laboratory, Cleveland.

Opportunity

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Chief Designer.—A first-class Chief Designer for Hindustan Aircraft Ltd., Bangalore, South India. Applicants should be qualified Aeronautical Engineers having at least 15 years' practical experience of design, have project and stress office experience, and have held responsible senior positions in the design department of well-established Aircraft Companies. Applicants should state clearly in chronological order the positions they have held, the work for which they have been responsible, and the salaries they have earned and should state the salary they would be prepared to accept, on the basis of a 5-year contract in the first instance, subject to 6 months' notice on either side. Passages would be paid to and from the home country and leave would be at the rate of one-eleventh of the time spent on duty. All other conditions of the contract would be according to the Company's standard terms given to their employees of non-Asiatic domicile. The Hindustan Aircraft Factory is situated in Bangalore in His Highness the Maharajah of Mysore's State. Bangalore has an equable climate, being at an elevation of about 3,000 ft. above sea level, the maximum temperature in the two hottest months not rising above 92°F. and at other times of the year not falling below 60°F. The factory shops cover a total area of about 1,000,000 sq.ft., and the Company is engaged in aircraft construction, repair, and maintenance work. It is a limited liability Company, the shares being owned by the Government of India and the Mysore State, and it forms the nucleus of the aircraft industry in India. Applications should be sent immediately by air mail and in any case not later than the end of August marked "Appointment of Chief Designer" to the address of the General Manager, Hindustan Aircraft Ltd., Bangalore, South India.

Aircraft Equipment and Accessory Engineer—Excellent opportunity for graduate A.E., M.E. or E.E. with at least 4 years' practical experience as application engineer on electromechanical actuators, electric motors, and automatic control for aircraft. Reply to Lear, Incorporated, 110 Ionia Ave., N.W., Grand Rapids 2, Mich.

Electronic Engineer-Pilot—A position is open for a highly qualified electronic engineer who is also an expert multiengined pilot. The work will consist primarily of flight research and test of aeronautical automatic controls of many descriptions. The engineer will be involved from the inception of an idea or device, through its development stages, in the planning and flying of the tests, to the final demonstration and sales stages. It is desirable that the applicant be skilled in instrument and airways procedures or is a former air-line, N.A.T.S., or A.T.C. pilot. Apply by letter, giving engineering and flight experience and starting salary expected, to Chief Flight Test Engineer, Minneapolis-Honeywell Regulator Company, 2753 Fourth Ave. S., Minneapolis.

Engineers—Young engineering graduates with up to 3 years' experience required for test activity and aerodynamic or thermodynamic analysis on extensive and continuing development programs on nonrotating aircraft power plants. Mechanical or aeronautical engineers preferred. Address reply to Continental Aviation and Engineering Corporation, Detroit 14.

Aerodynamicists—College graduates with sound theoretical training and at least 1 year of graduate study in compressible subsonic flow and supersonic flow to do research and test work in the Supersonic Wind Tunnel of the Ballistic Research Laboratories, Aberdeen Proving Ground, Md. This is one of the few operating supersonic wind tunnels in the country having a test section larger than 1 sq.ft. Remuneration in accordance with qualifications. Write, giving education and experience, to The Commanding General, Aberdeen Proving Ground, Md., Attention: Director, Ballistic Research Laboratories.

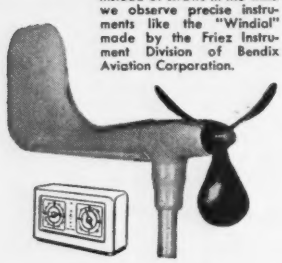
Structural Designers—Experienced in sheet-metal aircraft structures for new helicopter design. Graduate engineers from recognized universities preferred. Plant located in suburb of West Philadelphia. All replies will be held confidential. Write Personnel Department, Piasecki Helicopter Corporation, Sharon Hill, Pa.

Layout Draftsmen—Five or more years' experience on aircraft layout and design. Rotary wing preferred. Graduate engineers from recognized universities preferred. Plant located in suburb of West Philadelphia. All replies will be held confidential. Write Personnel Department, Piasecki Helicopter Corporation, Sharon Hill, Pa.

Silicone News

DC SILICONES

Instead of straws in the wind we observe precise instruments like the "Windial" made by the Friez Instrument Division of Bendix Aviation Corporation.



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That's another bit of evidence to support our claim that permanent lubrication means Dow Corning Silicone Oils and Greases. Within 5 years your customers will be demanding permanent lubrication. It's none too early to start working with the DC Silicone Greases described in data sheet No. S 7-4.

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Assistant Designer—Wanted immediately by Canadian branch of leading aircraft hydraulics and landing-gear specialists. Must be capable of taking full responsibility for undercarriage design projects, and should have had some experience in design of hydraulic pumps, systems, and electro-hydraulic units. Knowledge of stress analysis and familiarity with both British and American engineering practices also desirable. This is a permanent position with good prospects. Starting salary $275 to $300 per month, depending on qualifications. Apply in writing to Chief Engineer, Dowty Equipment (Canada) Limited, 999 Aqueduct St., Montreal 3, Canada.

Senior Draftsman—Wanted immediately by Canadian branch of leading aircraft hydraulics and landing-gear specialists. Must have minimum of 3 years' experience in the more mechanical side of aircraft design work and, preferably, 1 year's design experience on undercarriage and hydraulics, variable-pitch propellers, fuel systems, or other similar accessories. Should be capable of detailing any undercarriage or hydraulic layout and of carrying out elementary stress analysis. Familiarity with both British and American engineering practices also desirable. This is a permanent position with attractive prospects. Starting salary proportional to qualifications offered. Apply in writing to Chief Engineer, Dowty Equipment (Canada) Limited, 999 Aqueduct St., Montreal 3, Canada.

762. **Engineer**—Graduate engineer, mechanical, experienced in precision transmission systems. Aggressive expanding company. Suburb of Philadelphia. Replies will be kept confidential. Send complete résumé.

761. **Junior Electrical Engineers**—Graduate engineers from recognized universities preferred. To work on aircraft electronic systems. Plant located in suburb of West Philadelphia. All replies will be held confidential.

760. **Aircraft Electronic Engineer**—Experienced in flight-test instrumentation. Plant located in suburb of West Philadelphia. All replies will be held confidential.

742. **Automatic Pilot Project Engineer**—Wanted by leading manufacturer of electro-mechanical equipment with a complete automatic pilot staff, including top-notch gyro engineers, servo engineers, and electronic engineers. Requires experienced automatic pilot engineer to take charge of automatic pilot engineering to relieve company chief executive who has handled this personally heretofore but requires a project engineer because of increased work and expanding program. Individuals in our employ know of this opening so applicant need not be concerned about writing to his own employer. Location Middle West.

741. **Metallurgist**—College graduate with several years' experience in aircraft industry on control of materials, processes, and process inspection. To assume charge of quality control. An expanding aircraft concern, with excellent future. All replies will be held confidential. East Coast company.

739. **Instructor or Assistant Professor**—To teach courses in aircraft structures or aerodynamics in Aeronautical Engineering Depart-

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ment in Midwestern university. Minimum of 5 years' practical experience required; master's degree and previous teaching experience desirable. In replying please give complete record of personal qualifications and experience.

730. **Aeronautical Engineer**—Civil Service position open in Washington, D.C., for aeronautical engineer with experience in stability and control analysis. Salary $4,902 per annum. In applying please give brief sketch of personal qualifications, education, and experience.

724. **University Airport Operations Director**—Director of Operations position available at airport owned and operated by a large mid-western university. The director should be a pilot and a graduate engineer, have had some experience in operating an airport, and have an interest in flight research and flight training.

706. **Assistant Professor**—To teach courses in aircraft structures and aircraft structures laboratory at an Eastern university. The primary duties of the position will be concerned with aircraft structures, but the applicant should possess enough knowledge of aerodynamics to permit him to assist occasionally in elementary aerodynamic courses. Prefer a man with teaching and practical experience. In applying, please give brief sketch of personal qualifications, education, and experience.

679. **Professor of Aeronautical Engineering**—To take charge of work in established department of aeronautical engineering at a large engineering college. A man with graduate degree, teaching and industrial experience preferred. Rank and salary dependent upon educational background and experience.

671. **Instructor or Assistant Professor**—Sought by Aeronautical Engineering Department of Southwestern university. Should have master's degree and be able to teach in fields of aerodynamics and fluid mechanics, structures, and power plants and be capable of specializing in one of these.

670. **Research and Aerodynamics Engineers**—Long-term helicopter development program for Army Air Forces requires additional experienced and capable engineers. Exceptional working conditions and opportunities. Work involves aerodynamics, vibration, and flutter analyses on advanced designs. Substantial experience in aerodynamics or vibration work essential. East Coast company.

AVAILABLE

770. **Aeronautical Engineer**—B.Ae.E., 1942. Age 25, married. Two years' experience in design evaluation of regular and experimental aircraft. Two years' experience in aircraft flight testing and aircraft maintenance. One year's experience in supersonic research leading to the design of guided missiles. At present engaged as a research technician in supersonics. Desires position as an administrative or project engineer. Familiar with Government contracts and procedures.

769. **Aeronautical Engineer**—B.S. in M.E. (Aero.), 1942. Age 27, married. Five years' experience in layout and design on military and commercial aircraft. Some experience in wind-tunnel testing and aeronautical research. Desires permanent position with leading aircraft concern. Will locate anywhere in United States.

768. **Production-Management Engineer**—B.Ae.E., Rensselaer Polytechnic Institute, 1942. Five years' experience in engineering and management, including duties in liaison, salvage, design, and stress analysis. Three years' aircraft engineering officer in U. S. Marine Corps in complete charge of third echelon maintenance, repair, and overhaul, as well as command responsibilities. Desires responsible position requiring managerial capabilities in addition to engineering knowledge, such as production planning and control.

767. **Aeronautical Engineer**—Age 23, married. Four 'years' experience in air-transport field. Thoroughly familiar with aircraft structures and systems, weight and balance procedures, structural repairs, and servicing. Two years' experience in detail design and interior furnishing of large commercial aircraft including DC-3, DC-4, and L-49 aircraft. Desires position of responsibility in which engineering background will be of value. Available immediately.

766. **Aeronautical and Mechanical Engineer**—Age 25. B.S. in G.E. with A.E. Option from Georgia School of Technology. Considerable work toward M.S. completed. Three years' experience in the development of aircraft engines (conventional and jet) and propellers in the Engineering Division, Air Matériel Command, Wright Field as an officer. One year's experience in theoretical analysis of power plants, rocket research and development, and aerodynamics for guided missiles. Considerable experience as a pilot. Interested in sales engineering. Will locate anywhere. No objection to traveling. Good references.

765. **Aeronautical Engineer**—Age 28. B.S. in Mechanical Engineering from Illinois Institute of Technology. S. M. in Aeronautical Engineering from Graduate School of Engineering, Harvard University. Thirty months' Navy experience with the Bureau of Ordnance Aviation, Ordnance Section. Experience includes design, layout, drafting, and stress analysis of ordnance equipment. Desires work in experimental aircraft design and stress analysis.

764. **Engineer**—Ph.D., Master's, and Bachelor's degrees; age 30. At present, Director of Aeromechanics Department for large corporation engaged in research, design, and development in supersonic and subsonic guided missile programs. Formerly, Associate Professor of Aeronautical Engineering at midwestern university, teaching theoretical aerodynamics, supersonic and compressible subsonic flow, dynamic stability, and wind-tunnel courses. Desires professorship or associate professorship at recognized university with the possibility of some research or consulting or a responsible position in industry with good future prospects.

763. **Teacher**—Desires position teaching aeronautical engineering at recognized college or university. B.A.E. degree, magna cum laude. Graduate work in engineering partially completed. Three years of progressively responsible industrial experience, including analysis and design of tubular and stressed-skin structures and of the mechanical elements of civilian and military aircraft, with emphasis in rotary wing field. One and one-half years' experience as instructor of mechanical engineering at accredited college. Qualified to teach courses in aerodynamics, fluid mechanics, advanced strength of materials, airplane design, structures and stress analysis, and rotary wing aircraft.

759. **Powerplant and Engine Accessory Designer**—Graduate M.E., German university. Extensive design and testing experience. Fully conversant with engine layout and all phases of development. Considerable design and research background on fuel injection systems.

758. **Aviation Technical Writer**—Author of three technical books on aviation education, aircraft operations, aviation course of instruction. Has written technical magazine articles, aircraft manuals of operation, engine manuals, accessory description and operation manuals, service and overhaul manuals. At present teacher of high-school aeronautics. Would like assignments from schools, laboratories engaged in aeronautical research, factories and manufacturers that require technical aviation writings, and publications. Twelve years' practical experience in operational aviation.

757. **Flight Test or Research Engineer**—Aeronautical Engineering graduate with 5 years' experience in flight testing, flight research, and wind-tunnel testing. Has done military and C.A.A. acceptance flight tests. Special experience with with large aircraft test organization. Intends to leave West Coast. Desires equivalent position in the East; New York or New England Coast preferred.

756. **Aeronautical Engineer**—B.S. in Ae.E., age 24, single. Two years' maintenance engineering experience with the Army Air Forces. Fourteen months' experience as test engineer, mechanical laboratory, and test engineer in charge of stratosphere chamber with leading rotary wing and rocket airplane manufacturer. Desires position in structural, altitude, or wind-tunnel testing. Details and references upon request. Location open.

755. **Mechanical Engineer**—B.S. in Mechanical Engineering, age 28. Three years of performance estimation of gas turbines and thermodynamic analysis and design of gas turbine components. Three years of mechanical design of aircraft elements. Desires a responsible position with an active organization with plenty of work and an opportunity for advancement. Location unimportant.

754. **Aeronautical Engineer**—B.S. in Aeronautical Engineering, age 26. Forty months' experience in the Army Air Corps as an engineering officer in charge of maintenance and equipment development. Desires position in aerodynamic research but will also consider other positions. Sound theoretical background in stress analysis and aerodynamics as well as practical experience in heavy aircraft maintenance. Details and references upon request.

753. **Engineer**—B.M.E., 1943. Nine months as assistant project engineer on automatic aircraft control. Two years as aerodynamics engineer on piloted and pilotless aircraft. For past 6 months in charge of projects to simulate in laboratory the behavior of guided missiles and their control equipment while in flight. Desires improved opportunities.

752. **Engineer**—Age 36, 3 years' college engineering; 2½ years as an engineer in the aircraft industry; specialist in weights and balance; holds valid A. & E. license; approximately 10 years all-round technician on all types of aircraft. Would like to represent aircraft manufacturer in the field.

751. **Aeronautical Engineer**—Seven years' air-line and manufacturing experience, mostly on heavy multiengined aircraft covering tool design, group leader equipment installation design, service and liaison engineering, flight testing, direction of preparation of flight and maintenance handbooks, and progressive maintenance systems for U.S. Navy and a major air line. Desires responsible position with air line or manufacturer, domestic or foreign. Excellent references furnished.

750. **Aeronautical Engineer**—B.Ae.E., age 24, single. Two years' experience in flight testing, primarily jet-propelled aircraft. Three and one-half years with A.A.F. as navigator, experimental engineering officer, and administrative officer. Seeks position in aeronautics, preferably development and/or liaison.

748. **Aeronautical Engineer**—Bachelor's and Master's degrees in Aeronautical Engineering. Presently holding responsible executive position with well-known helicopter manufacturer. Desires new connection either in industry or at recognized university. Broad general aircraft experience; author of several published papers on rotating wing aircraft and general design; well-known in industry and C.A.A. circles; teaching experience in field of structural design.

747. **Helicopter Flight Test Engineer**—Age 27, married. B.S.E. (Aero.), 1943. Familiar with C.A.A. flight test procedures and data reduction necessary for helicopter certifications. Four years' aviation experience includes flight-test instrumentation, conventional aircraft flight sched-

uling. Desires position in Midwest in related or nonrelated field where background would be of some benefit.

746. Aerodynamicist—Age 28; B.S. and M.S. degrees in Ae.E. Five years' experience in aerodynamic design of commercial and military aircraft. Considerable experience with static and dynamic stability analyses of aircraft. Desires responsible position either with aeronautical college or with aircraft industry.

745. Aeronautical Engineer-Teacher—Presently employed design engineer would prefer a change to teaching position. Work in aircraft industry or in aero-insurance field also desirable. Scholastic record includes B.S. degree in Mechanical Engineering and graduate study in applied mechanics, plus M.S. degree from Harvard Graduate School of Engineering. Over 6 years' industrial experience on gliders, large (four-engined), and small aircraft, amphibians and jets. Has been chief of structures and aerodynamics on light aircraft; handled approval of important aircraft designs while working for C.A.A.; has also handled safety and accident analysis, and C.A.A. design and liaison work for large aircraft manufacturer. Teaching experience includes graduate assistantship at leading university and appointment as Instructor in Aeronautical Engineering on part-time basis.

744. Project Engineer—Age 29; M.Ae.E. Nine years' experience in design and development of aeronautical and mechanical components. Recent experience in guided missiles and in direction of groups engaged in aeronautical development work. Especially interested in coordination of new development work.

743. Aeronautical Engineer—Bachelor of Ae.E., Master of Ae.E. from New York University, majoring in aircraft structures. One and one-half years' experience as student and graduate assistant and some experience in research department of large Eastern aircraft company. Interested in obtaining position in structural research or structural test.

740. Aeronautical Engineer—B.S. in Aeronautical Engineering. Nineteen years' experience in military and commercial development and flight testing. Specialized in aerodynamics, flight test, power plants, and weights. Has professional license. Desires position in development of personal airplane. Interested in Southern California location.

738. Aviation Representative—Executive. Married. Seven years' air-line experience. Possesses good working knowledge of all departments. Broad communications experience—supervisory and administrative. Some flying experience plus working knowledge of dispatching, meteorology, instrument flying, and navigation. Alert, reliable, mechanically inclined. Executive ability. Interested in organizing a helicopter operation, or cargo or feeder air-line. Will consider responsible position with an organization needing a well-informed aviation representative. Will furnish references on request. Interview desired.

737. Engineer—Age 33, married. Aeronautical and mechanical engineering education. Nine years' experience in aircraft industry including all phases of design and analysis of airplane structures. Would like position with growing concern. East Coast preferred.

736. Spare Parts Requirements Specialist—Graduate of 2-year aeronautical engineering technical college; C.A.A. mechanic's license; 3 years with A.T.C. and A.T.S.C. as assistant aircraft maintenance officer specializing in scheduling the repair of spare parts and anticipating need for same before actually needed. Presently employed and has 2 years' experience with a major air line, mainly in provisioning spare parts. Has a thorough practical knowledge of engineering and maintenance problems and practices. Desires connection with an air line or company planning to enter the air transportation business. Preference is New York Area.

735. Engineer—B. of A.E., 1942, with honors. Postgraduate study in mathematics. Training background includes extensive experience as a machinist and as a draftsman. Flying experience. Experience as development engineer working on all phases of aircraft propeller theory, testing, and production. Two years as an engineering officer in the U.S. Navy. Last duty as an administrative engineer with the Office of Research and Inventions. Experience with large aircraft company as a research aerodynamicist working on subsonic and supersonic rocket aircraft. Design engineer, procurement engineer, and sales engineer with mechanical machine company. Exceptional administrative and sales ability. Personable appearance and can deal effectively with people. High engineering aptitude and understanding proved many times in practice.

734. Aircraft Equipment Engineer—Age 33, married. Fourteen years' experience, including: 1½ years as aircraft mechanic; 2½ years as assistant chief engineer small aircraft plant; 1½ years as group leadman on experimental aircraft project, doing layout, lofting, stress analysis, weight and balance; 8 years with major aircraft company as layout draftsman, engineering designer, shop liaison engineer, modification and salvage engineer. Research and development work on passenger comfort and lightweight seating. Familiar with Army and C.A.A. regulations. Desires chance for advancement with manufacturer, research organization, or maintenance base. Prefers West Coast.

733. Engineer—Nine years' experience in manufacturing and materials and process engineering. Also some experience in stress analysis, structural testing, and design. Desires position in materials and processes, research, production design, or manufacturing field with air-line, airframe, or accessory manufacturer.

732. Chief Power-Plant Engineer—B.S. in M.E. Twenty years' experience in airplane design as draftsman, weight computer, stress analyst, flight test observer, project engineer, power-plant engineer, and chief power-plant engineer. Fifteen years as power-plant installation specialist. In charge of power-plant design and technical calculations for many outstanding military and commercial airplanes. Turbojet and rocket experience. Successful administrative record in handling design groups. Desires administrative position with progressive firm in engineering department of aircraft company or in installation department of engine manufacturer.

731. Aerodynamics; Design; Structures; Management—Experienced in all phases of aircraft design and manufacturing. Ex-assistant chief engineer, chief aerodynamicist, chief of stress, project engineer. University of Michigan graduate, B.S. Ae.E., B.S.M.E. Age 30, married. Desires work in New York City vicinity. Complete information given on request.

729. Plastics Engineer—B.S. in M.E., Cornell, 1940. Age 30, married. Wishes to organize low-pressure molding department or section of laboratory for aircraft concern designing surfaces that must carry radar equipment or have supersonic smoothness. Five years' experience in aircraft applications of plastic resins, thoroughly familiar with practical laboratory and production techniques; also with design and lofting requirements for low-pressure molds.

728. Aeronautical Engineer or Teacher—B.S. Ae.E., now completing master's work at the University of Michigan in aerodynamics, propulsion and research techniques. Received Rotary Wing Scholarship in 1946. Reads and speaks French and German. Has done tutoring in physics and aeronautics. Three years' experience as assistant project engineer on development, design, and manufacture planning for aircraft instruments and subsonic wind tunnel.

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727. Tool-Production Engineer—Age 34. Fifteen years' experience sheet metal and precision metalworking fields in production supervision, tool design, aircraft layout drafting, production engineering. Last 8 years in aircraft, last 2 years as Chief Tool Engineer. Capable administrator, considerable experience in labor relations. Desires position in tool or production engineering leading to responsible position requiring administrative ability.

726. Aeronautical Engineer—B.S. in Ae.E., 942, plus additional engineering studies. Age 25, single. Five years' experience, including 3 years' layout design and 2 years' engineering experience in another field having to do with the fabrication and production design of ceramic product. Experience in processing, testing, research, and field service in capacity of Practical Engineer. Prefers position in administrative capacity, field service or design group. Free to travel anywhere. Complete information will be given on request.

725. Airplane Structures Engineer—B.S. in M.E. from recognized state university. Five years' experience in airplane structural design, major stress analysis and air loading with leading aircraft manufacturers and 3 years of experience with Federal Government agencies having cognizance of aircraft airworthiness. Some teaching experience and author of text on flight loads. Desires position in aeronautical or mechanical engineering or teaching involving structural design, stress analysis, fluid mechanics, or other analytical or research work.

723. Aeronautical Engineer—Young Puerto Rican, 20 years old, American citizen; graduate of Academy of Aeronautics, February, 1947. Speaks and writes Spanish. Will accept position in New York, Puerto Rico, or South America.

722. Research Engineer—Age 29, married. B.S. Ae.E., 1943. M.S. Ae.E. expected in 1947. Three and one-half years' research experience including general aerodynamics and subsonic and supersonic wind-tunnel testing. Supervisory experience.

721. Engineering Writer—B.S. degree in Aeronautical Engineering, Purdue. M.S. in Journalism. Married; 23 years old. Has taught aircraft structures and mathematics. Wants to work with a technical publication as assistant editor or similar post. Although magazine work is preferred, will consider any position that would draw upon engineering and writing training. Would be interested in college teaching.

720. Development or Design Engineer—Twelve years' specialized in power plant installation, design, test, research and proposal work as designer, group engineer and senior project engineer. Also familiar with design, test, and performance calculations of exhaust ejector pumps and thrust augmenters, and some design of ramjet engines. Five years' air-frame design experience and 5 years' diversified shop, tool engineering, and plant engineering work. Since end of war, partner in a small Midwestern engineering company doing some work on airplane component design. Well versed in organizing and follow through of projects and in dealing with personnel. Born, graduated, and 5 years' engine-design experience in Germany. In United States since 1929; citizen since 1935; age 45; married. Desires position with airplane or component manufacturer or operator as a design development, test, field, or maintenance engineer. Starting salary and location secondary if opportunities are right. Available immediately.

719. Aeronautical Engineer—B.S. degree in Aeronautical Engineering; graduate work, majoring in physics; age 31. Eight years' aeronautical engineering experience, consisting of 6 years in stress analysis, structural testing, and structural design criteria development and 2 years in preliminary aircraft design. Thoroughly experienced in aerodynamics, aircraft structures, and design. Capable as a project engineer and in the supervision of engineering and laboratory personnel. Desires position requiring initiative and responsibility in which engineering experience and background will be of value.

717. Aeronautical Engineer—M.S. in Ae.E.; A.B. in mathematics. Four years' experience in stress analysis, flutter, and vibration with leading aircraft firms. Interested both in teaching and in industry, preferably in New York area.

716. Pilot—Position wanted as pilot for private concern with sales engineering possibilities. B.S. in Ae.E. Four years' engineering experience with airplane manufacturers. Four and one-half years' air-line experience in twin-engined and four-engined equipment; 2,600 hours' logged time. C.A.A. ratings held—commercial, single- and multiengined land, instrument, and instructor. Free to locate anywhere but Chicago preferred.

715. Instrument Engineer—B.E.E., Cornell University, 1943. Four years' experience with recording and indicating instrumentation in flight test division of leading aeronautical research laboratory. Developed instrumentation and calibration techniques and supervised the installation and maintenance shop personnel. Desires position with aeronautical laboratory or instrument manufacturer.

714. Aeronautical Engineer—B.S., Rensselaer Polytechnic Institute. Age 24. Well experienced in the structural analysis and design development of supersonic military aircraft and missiles. Additional experience and background include aerodynamics major as undergraduate and 3 years in U.S. Navy as aircraft engineering officer-specialist in structures and engine maintenance and repair. Desires permanent position with West Coast aircraft concern. Prefers to continue work in supersonic research and development in either structures or aerodynamics.

713. Manufacturers Representative, Sales, or Field Engineer—Engineer with 17 years' aeronautical design, plus 3 years of successful aircraft sales engineering experience. Has technical, executive, and sales ability. Desires connection with distributors or manufacturers to handle products selling to West Coast aircraft industry. Well known to both engineering and purchasing personnel of California aircraft companies. Available immediately.

712. Materials, Processes, and Standards Engineer—M.E. degree; seeks position with aircraft or metal fabricating plant in New York Metropolitan area or Long Island. Excellent record: nationally known author; prominent welding consultant; authority on materials, processes, and standards; research; design; administration; production; industrial engineering; estimating. Presently employed with one of America's foremost aircraft companies.

711. Professor of Aeronautical Engineering—B.S. in M.E.; M.S. in A.E. Five years' teaching experience as Associate Professor of Aeronautical Engineering, in well-established engineering college. Five years' varied industrial experience, including development work on guided missiles. Desires permanent position in recognized engineering college teaching airplane design and aerodynamics. Primarily interested in research and development of light planes. Available immediately.

710. Aeronautical Engineer—Married; age 30. Four years' experience in structures and static test. Experience in electronic instrumentation for testing. Six months at Wright Field as company representative for static test of large airplane. Two years' experience in structural and mechanical design for high-speed variable density wind tunnel. One year in Navy radar program. Now attending California Institute of Technology. Will obtain M.S. in Aeronautics in June. Would like industrial research or teaching and research with work toward a higher degree.

709. Aeronautical Engineer—B.S. in Ae.E. Experience includes structural testing, drafting, and liaison on both military and commercial aircraft. Seeks position in structural testing or wind-tunnel testing. Location open.

708. Aeronautical Engineer—Financially independent, as the result of successful designs, desires new position on West Coast with sufficient authority or scope to be able to obtain results. Successful projects previously headed, both commercial and military, will be furnished as proof of ability to lead either design or research developments. Salary is of minor importance.

707. Sales Engineer—Engineer with 27 years' experience in aircraft engineering and manufacturing. Has ingenuity and engineering ability combined with sales ability. Desires sales engineering connection in Los Angeles area in any field requiring these characteristics.

705. Aeronautical Engineer—Former pilot; long and broad experience in nearly all phases of airplane design, manufacture, and operation. Lately specializing in gas turbines and hydraulics. Especially interested in development.

704. Aeronautical Engineer—Seventeen years' experience on airplanes and 2 years on helicopters as layout man, group leader on drafting, design draftsman, chief draftsman, project engineer, design engineer, and assistant chief engineer, concerning commercial and military aircraft. College education and 5 years' original experience in mechanical engineering.

703. Aeronautical and Aircraft Maintenance Engineer—B.Ae.E., N.Y.U., 1944. Two and one-half years' overhaul, maintenance, modification, and repair of single- and multiengined aircraft in both military and commercial aviation, plus previous limited association with manufacturing industry. Seeks a responsible engineering position to which adaptable in either manufacturing industry or air transport. Will consider overseas employment.

702. Engine Research Technician and Draftsman—College background; 2 years' aeronautical engineering; 29 years old; married. Nine years of technical and practical experience in aircraft-engine production and development. Thorough familiarization with engine design and development, laboratory testing and research, engineering analysis, and layout and detail drafting. Two and one-half years' experience with gas-turbine and jet propulsion engineering projects at U.S. Navy Air Test Research Center. Desires permanent position with leading engine manufacturer or experimental development unit in research, development, designing, or liaison capacity, preferably in New England or Eastern Coastal area.

700. Project Engineer—Age 36. B.S. in M.E., plus some postgraduate work. Nine years' experience in production and development of electromechanical instruments. This work has included considerable time spent with laboratory, manufacturing, and inspection groups and also with customers on related engineering problems. Especially interested in cost-reduction work. A complete outline of experience and qualifications will be sent upon request.

699. Chief Inspector or Experimental Department Head—Twenty years' experience in the aircraft industry, including experimental, quality control, and production analysis. Seeks position as chief inspector or head of experimental department. Location open.

698. Engineer and Executive—Almost 30 years' experience on airplane and accessory design, airport selection and layout, and airplane operations engineering. Good organizer and manager; sound business experience; capable technical writer; wide knowledge of materials and processes.

697. Aircraft Structural Engineer—Graduate engineer, B.S. in M.E., Ae.E. Two years' aircraft structural design and research experience. Design experience gathered with both military and personal aircraft. Thoroughly familiar with C.A.A. requirements and static testing. Structural research experience gathered while in the Army Air Forces. Desires position in structural design or structural research department. Will locate anywhere.

696. Aeronautical Engineer—B.S. in Ae.E., New York University (Guggenheim School of Aeronautics). Almost 2 years' mechanical training and experience in the A.A.F. Six months' experience with small West Coast aircraft company performing design and stress analysis of major components of prototype airplane under supervision of chief engineer. At present, graduate student at M.I.T., specializing in rotary wing aircraft working toward S.M. in Ae.E. Good grades throughout schooling. Desires position with progressive helicopter company. Details and references upon request.

XS-1 Research Airplane

(*Continued from page 26*)

objective reporting of the phenomena attendant with high-speed flight. He has also been reluctant to repeat his experience and, hence, investigate the various manifestations of phenomena associated with flight at critical Mach Numbers.

There has been adequate evidence from flight tests to show that the behavior of an airplane at a given Mach Number does depend somewhat upon q and that its behavior at high altitude is not the same as at low altitude for a given Mach Number. The aerodynamic forces that can act upon the airplane are greatly reduced at high altitude, presenting reduced structural problems and tending to reduce the magnitude of buffet stress. The reduced drag encountered at high altitudes also means greater accelerating force to minimize the time during which the pilot need be subjected to a given critical Mach Number while increasing his speed.

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The Paul Kollsman Lending Library
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This library loans books without charge to members and others in the United States over eighteen years of age. Full information will be sent on request.

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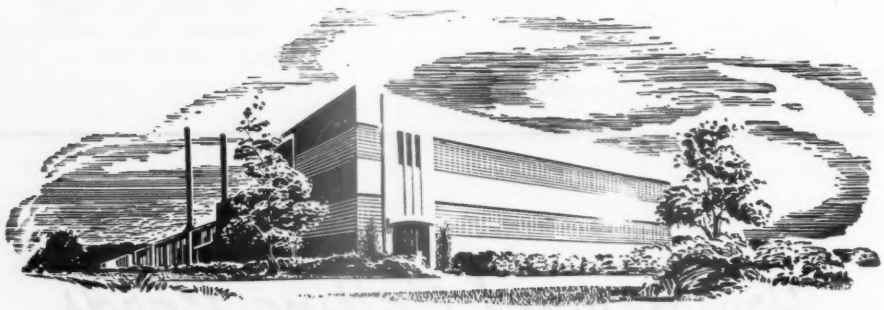

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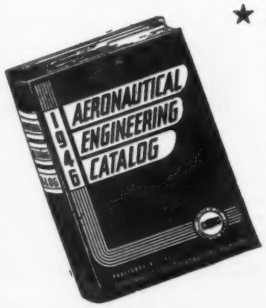

★ *Specifications and further information on the aircraft products of these companies will be found in the* **1946 AERONAUTICAL ENGINEERING CATALOG**

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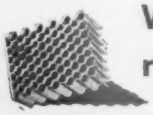

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